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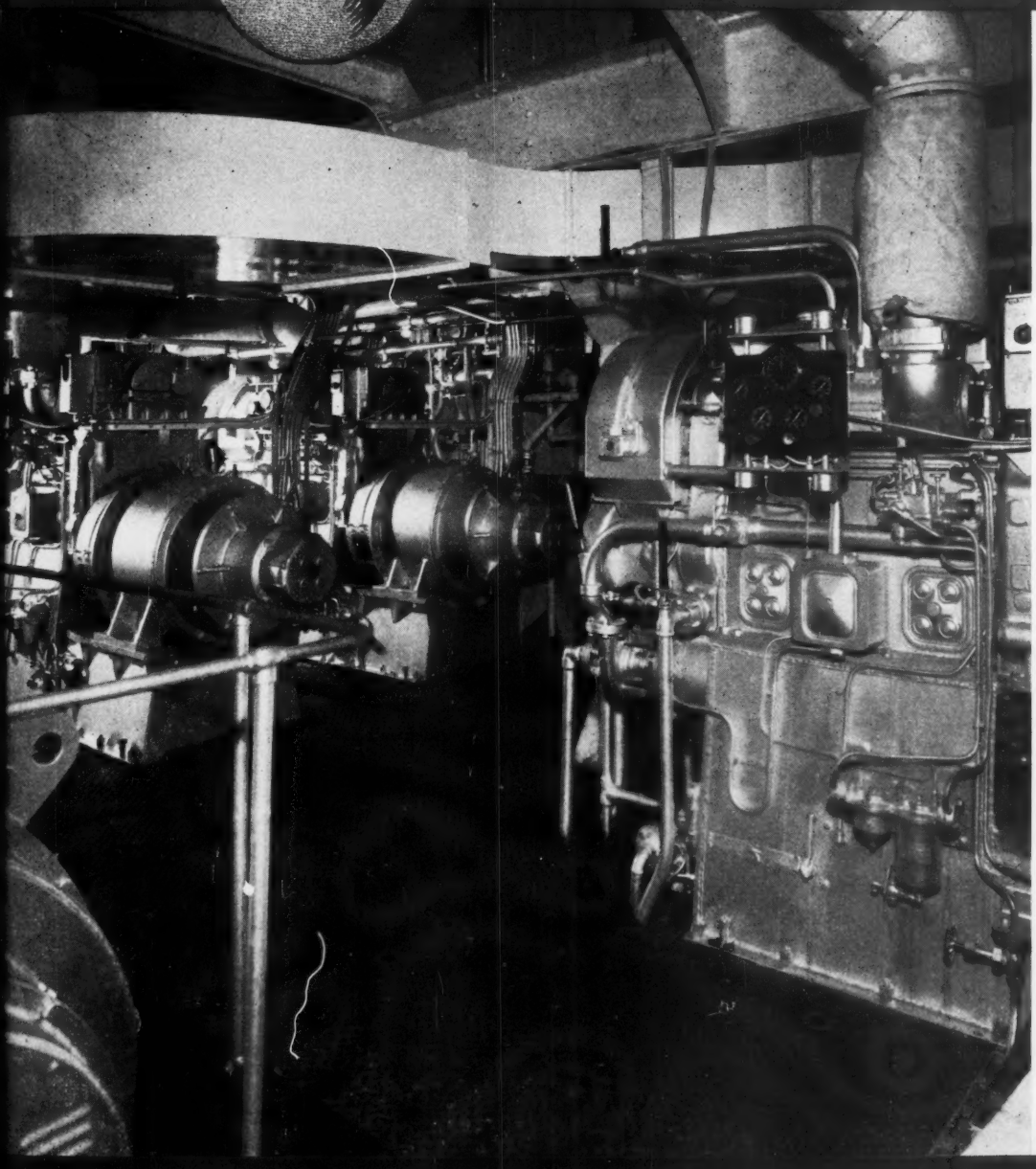

MAY
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1947

Vol. 3 No. 2

JOURNAL OF THE AMERICAN SOCIETY OF LUBRICATION ENGINEERS

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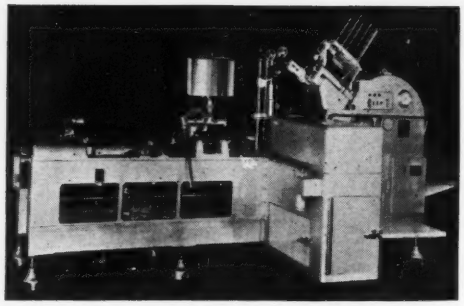

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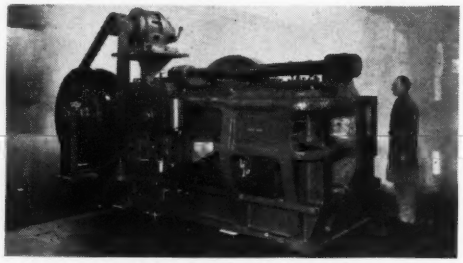

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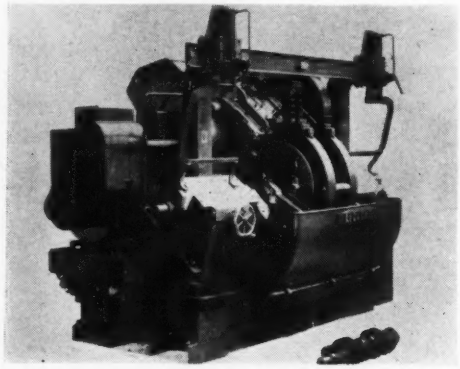

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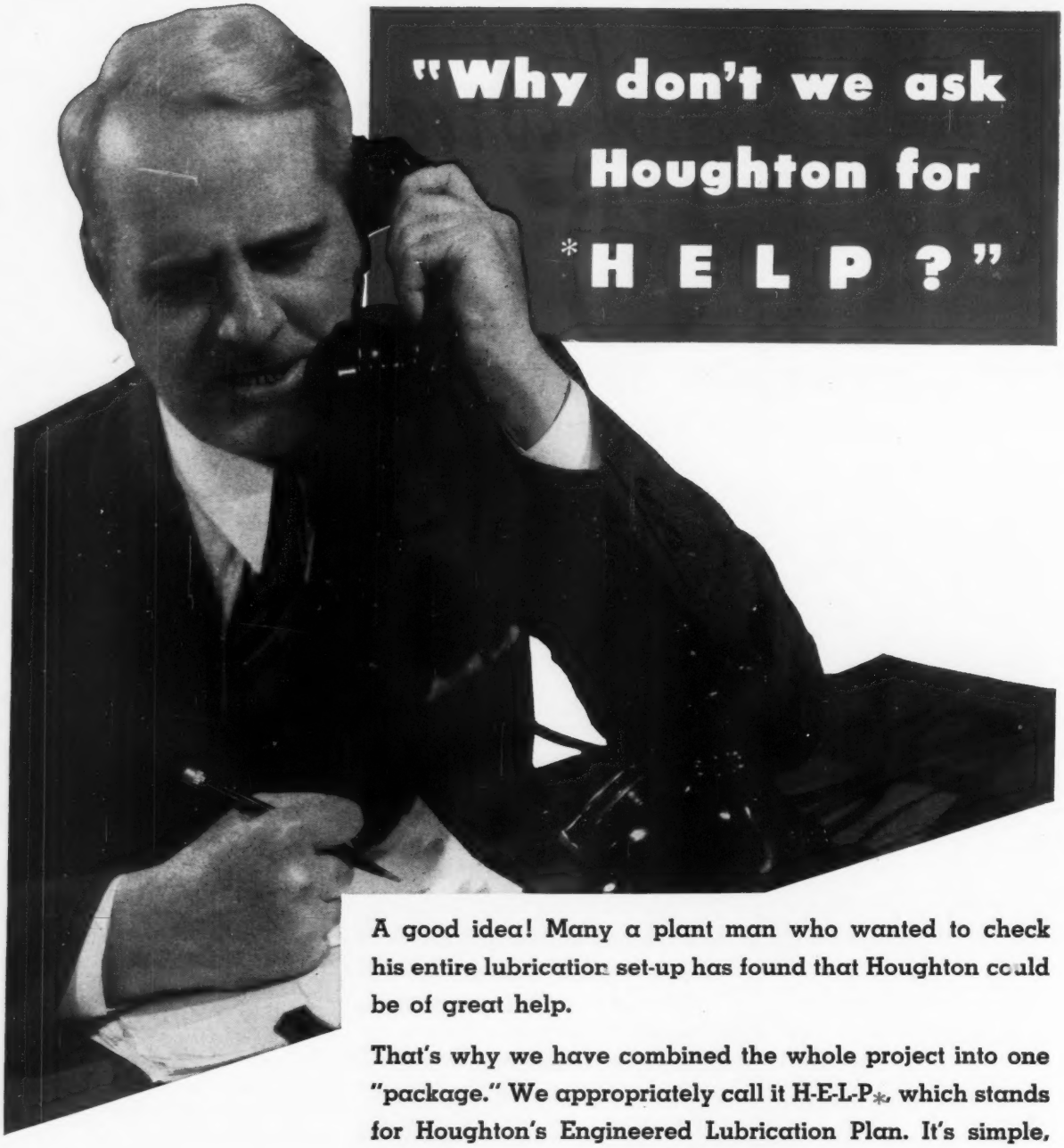

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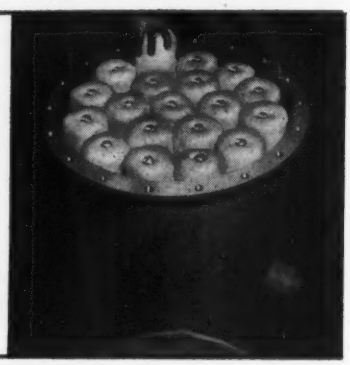

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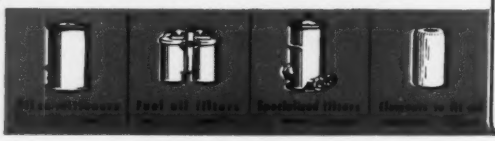

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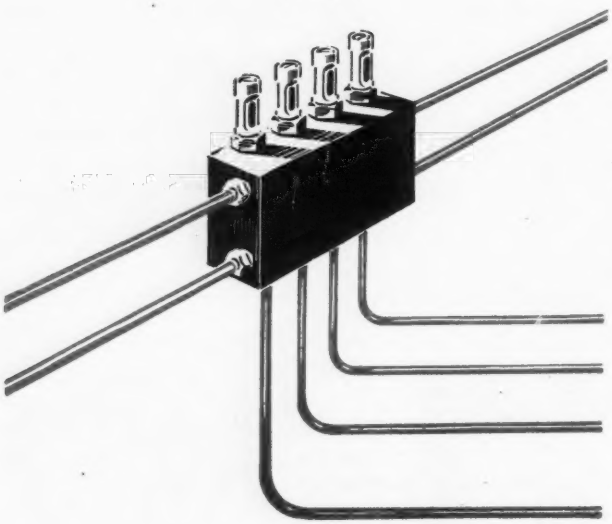

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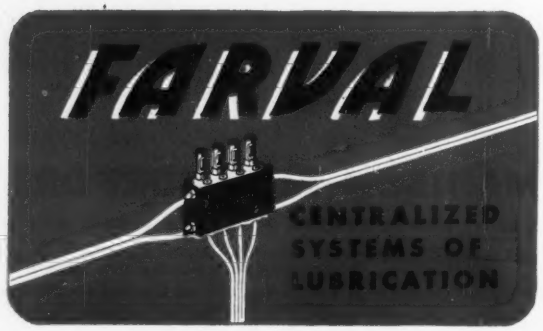

OSCAR L. MAAG

Oscar L. Maag, new President of the American Society of Lubrication Engineers, was born in 1890 in Russell, Kansas. He attended the University of Kansas where he received both his BS and MS Degrees. Following graduation he was with the Kansas City Testing Laboratory, U. S. Bureau of Standards, and the Galena Signal Oil Company until 1923 at which time he joined the Timken Roller Bearing Company with which Company he has been associated ever since. He now occupies the position of Research Chemist and Lubricating Engineer.

He is married and has two children. He is a member of many technical societies, including the American Chemical Society, Society of Automotive Engineers, American Association for the Advancement of Science and the American Society for Testing Materials. In the latter Society he is extremely active as Chairman or member of many of the technical committees of the Society associated with cutting fluids and greases.

Mr. Maag is an all around good fellow, is active in community affairs, enjoys all sorts of sports, gardening and travel.

The Society is fortunate in having Mr. Maag as its leader.

Editorial

The future of the American Society of Lubrication Engineers looks bright to those of us who have followed its growth, and the wide acceptance of the Society has been very gratifying. As long as the Society continues to show promise of well serving the many needs and wants of its members and of the industries that produce lubricants, it should continue to grow. Our growth and acceptance will be only in direct proportion to the effort each and every one exerts for the Society, and the return that each member receives will also be in proportion to the interest and effort he supplies.

The Society is serving its members both through its sectional and national meetings. At such meetings men become acquainted with other men interested in the same work. There is a free exchange of ideas and open discussion of lubrication problems that confront the industry and the technical and scientific papers should be of real value to all who hear them.

The producing industry is served by obtaining valuable first-hand information on what the practical problems are from men who apply and observe how lubricants function under operating conditions. It can then furnish the best lubricants for conditions encountered and is able more intelligently to develop new and better lubricants. The consuming industry will naturally gain materially by longer life of machinery, fewer shut downs, increased production, and lower operational costs. The information and knowledge gained by this cooperative effort will enhance our educational program already under way, so that future lubrication engineers will better serve both the producing and consuming industries. It is very evident that by following such a program no one loses and every type of our membership gains.

We must, however, learn from our membership what the future desires or needs of our interested parties are and then set about in an orderly manner to fulfill those desires and needs. Already in quite common use is a numbering system for consistencies of lubricating greases sponsored by producers of grease lubricants. This certainly has proven very valuable to both the producing and consuming industries. It has furnished us with a common and simple yardstick that all interested parties use intelligently. There is, also, considerable interest shown in a numbering system for gear oils based on viscosity of the oils that will be very valuable to all of us.

The thought then follows: should the ASLE sponsor a numbering system for the wide range of industrial oils based on viscosity that are used by industry. None of these systems considers quality which must as yet be left to the producer. Good American competition will take care of quality. Services such as these and many others that the members deem of value, should be considered. Only by performing tasks that industry and our membership desire can we properly serve interested parties. If we do not serve and produce, we have no right to expect or receive their support. Ours must be a cooperative effort for the advancement of lubrication that will benefit all of us, a partnership effort of men in industry to handle industry's needs.

OSCAR L. MAAG
President

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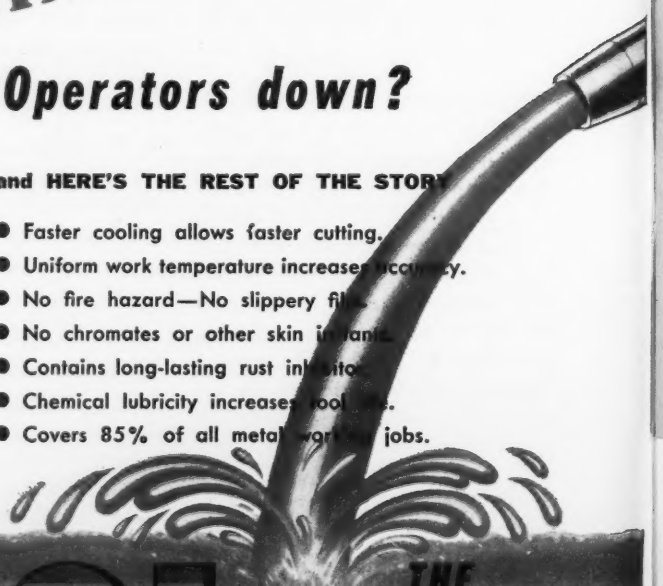

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Symposium—Scientific Lubrication as a Profit Factor

The fourth technical session of the second national meeting of the American Society of Lubricating Engineers, in Pittsburgh last March, consisted of the two papers which are reproduced herewith and a discussion period carried on by Mr. W. F. Leonard, Chairman of the session.

The discussion brought out further evidences of the economies and savings to be effected by the operation of well conceived and well executed lubrication programs, and also indicated a community of interest in lubrication and a similarity of problems involved in widely divergent industries.

The need for overall lubrication engineering in its broadest sense, not only in industries using machinery in production, but also in the engineering and designing departments of manufacturers of the tools that industry uses, was emphasized by many who took part in the discussion. It was indicated that the total cost of lubricants in a given plant is absolutely no indication of the worth or need of a lubrication program, nor is the cost per gallon of lubricants used to be the only factor in evaluating their suitability.

Mr. Pope's paper indicates briefly some of the reasons why lubrication engineers are needed in modern industry. Superintendents, foremen and master mechanics, he says, are too heavily laden with other responsibilities to give lubrication sufficient consideration, yet rising costs of materials, equipment and labor necessitate the realization of economies that an adequate lubrication program can afford.

Justification of Lubrication Engineering To Management

By C. L. POPE
Lubrication Engineer, Eastman Kodak Co., Rochester, N. Y.

MANAGEMENT might well question what this relatively new profession is that is seeking professional standing alongside the older established civil, mechanical, and electrical engineers. It is necessary to review briefly the history of the lubrication of mechanical equipment in order to explain the opportunity that has been afforded this new profession of lubrication engineering.

Early machines were slow moving, lightly loaded mechanisms and various animal fats and vegetable oils sufficed. At approximately the same time that the steam engine, electric motor, and internal combustion engines were developed, we had the development of mineral oil. Engineers have given us countless mechanisms and the petroleum chemist has kept pace by providing innumerable products from mineral oil. This condition makes it imperative for one to devote his full time to the subject if he hopes to have an understanding of the field of lubrication engineering.

Many years ago the men that operated machines were virtually all skilled mechanics. They usually not only lubricated their machines, but maintained them as well. Thus, plants had skilled men lubricating equipment. Shortly after World War I most companies found it advantageous to centralize the maintenance of machine tools. This has led to an unfortunate situation in many plants. The oiling job was established as a low skilled, low paid job. As a result, there is no incentive for a good man to apply himself, and the cost of neglect is buried in the maintenance and production cost of a business. No small part of the high cost of manufacturing during World War II was due to lack of trained men within industry to carry on the important function of lubrication. The oil company salesmen and engineers were taxed to the utmost. This background leads up to the lubrication engineer as his work depends upon having reliable, intelligent and interested people to carry out his directives and policies.

Lubrication is not as yet a part of the curriculum of engineers. As a result, engineers are dependent upon oil company engineers, maintenance men and casual self-study of lubrication recommendations and preventative maintenance practices. This leaves a very attractive field for engineers to work in, which is further enhanced by increasing costs of maintenance and investment in mechanical equipment. It is the purpose of this brief paper to point out a few of the things we might expect a lubrication engineer to accomplish. This should enable the management of a company to decide whether or not they can afford to be without lubrication engineers. In addition, you people who are interested must study the field and your own company so that you can present a program to your management. No manager will turn down a profitable proposition. Without some one taking the initiative, the management's hands are tied, as lubrication engineers are not readily available and so must be developed by personal initiative and sympathetic management. At this point, we do not wish the smaller companies to pass over this program lightly. Volume or total cost of lubricants purchased may have very little bearing on costs encountered wherever lubricants play a part. Secondly, the oil suppliers are in business to make a rightful profit and by no means can they afford to send in high priced lubrication engineers to solve our problems if in return they are not assured of a reasonable volume of business. All figures used in this paper are arbitrary for obvious reasons and may not represent anyone's costs. They are only injected to give a sensible appreciation of what is involved. The justification for a lubrication engineer and job requirements will become evident in the development of this paper.

Origin of Required Lubricants

Orders for lubricants originate in many places in a company. They may be from the foreman of a department, the engineering department, master mechanic, machine shop, purchasing, reciprocity agreements or equipment manufacturer's recommendations. There are usually a few other individuals who can influence or initiate the purchase of lubricants. This all indicates that fifty or more people may be involved part time in a casual manner in a field which directly affects the cost of operation. Most decisions are a matter of opinion or judgment and relatively few facts are considered. Duplication of effort and lack of interchange of information is costly. A survey for or by the management can be made in a week or two showing the following:

1. Number of people originating orders for lubricants.
2. The position held by each person.
3. Number of lubricants purchased.

The Author

Mr. C. L. Pope attended school at Moses Brown and Cornell University. He served an apprenticeship in the shops and foundry of the Wright Aeronautical Company, after which he was identified with the textile, heavy chemical, and automotive manufacturing industries, before joining the Eastman Kodak Company.

For seventeen years, he has acted as the Lubricating Engineer at Kodak Park, Rochester, N. Y., and as Chairman of the Lubrication Committee of the three Rochester divisions of the Company. During the War, cooperative work was carried on with the CRC and he acted as consultant to the Manhattan Project at Oak Ridge on lubrication and maintenance matters.

Mr. Pope is head of the Lubrication Engineering staff at Kodak Park, which includes Mr. W. T. Everitt, a Director of the A.S.L.E., and two other Lubrication Engineers, together with a chemist. He is also Chairman of the Petroleum Application Committee of the A.S.M.E., a member of the American Gear Manufacturers Lubrication Committee, and actively participating in A.S.T.M. development work.

4. Unit quantities, i.e., bottles, gallons, 5 gallons, 55-gallon drums.
5. Total quantity of each lubricant purchased per year.
6. Method, if any, of anticipating requirements, number of stock rooms, etc.
7. Number of brands believed to be interchangeable or equivalent.
8. Number of people contacting oil company salesmen and engineers and if possible, an estimate of the time spent per year.

On item 7 the individual making the report will most likely need the help of an oil company representative unless they have had many years of experience. In our own case, among other things we found ink oil, quenching oil, floor oil, paraffin oil, light engine oil, form oil and a cutting oil to cut back heavy base oil were all one and the same thing. In other words, we were purchasing, stocking, and dispensing seven oils where one would do.

Accounting, Purchasing, Stores and Receiving Departments

With the initial report in hand, the aid of the accounting, purchasing, receiving and stores department should be sought to determine the benefits they would receive. At this time, some figures may be injected as estimates. The accounting department should be able to advise what it costs to initiate a purchase order, purchase the item, receive it and keep the records. Let's say this cost is $3.00, and the survey indicates that one hundred lubricants are purchased on an average of once a month.

100 lubricants × 12 months = 1200 purchases per year @ $3.00	$3,600
Standardize on 20 lubricants purchased four times per year	240
Savings per year	$3,360
Purchase 100 lubricants in small quantities—6,000 gallons @ .80	$4,800
Purchase 20 lubricants in 55-gallon or 400-lb. units—6,000 gallons @ .50	3,000
Savings per year	$1,800
Total purchase savings per year	$5,160

At this point, the management should be able to estimate some return on their investment in a lubrication engineer, although this is the smallest direct saving that a lubrication engineer can make.

If the lubrication engineer goes to work, you may find that the cost of lubricants may well increase in order to reduce maintenance costs. However, reduction in consumption through better application of lubricants normally more than offsets any price increases many times over. The plant the writer is responsible for has increased almost 300 per cent in size, yet approximately the same volume of lubricants still meets our requirements. If we had not worked on this lubrication program, purchases today would be about $100,000 a year higher than they are. This is where the lubrication engineer is of inestimable value to the purchasing agent as he needs someone to interpret the price he is asked to pay for lubricants. You will find that every purchasing agent is interested in only one thing and that is to obtain value for the dollar spent. Another credit for the lubrication engineer which is chargeable to the purchasing department is the interviewing of oil company and lubrication equipment representatives. By knowing the overall plant problems, the lubrication engineer can save considerable time and prevent the duplication where many people are involved. This requires close co-operation and understanding with the purchasing department as normally the lubrication engineer is in a staff advisory capacity to the purchasing department. By having one individual who is well informed on lubrication problems one can derive the maximum advantage from contacts with the oil company representatives.

Lubrication Maintenance Costs

As every plant is somewhat different, one cannot use the same approach to evaluate maintenance costs of lubrication. It is hoped that the following examples may give some ideas along which a prospective lubrication engineer might look for support of his program.

As an example, let's take a 700-gallon oil system in a paper machine drum drier system.

FORMER COST

700 gallons initial charge of oil @ 70c	$ 490
200 gallons per year make up oil @ 70c for 7 years	980
Removing bearings, cleaning oxidized oil and replacing bearings at end of 7 years	24,000
	$25,470

$25,470 ÷ 7 years = $3,638 per year.

PRESENT COST

700 gallons initial charge @ 85c	$595
50 gallons make up oil @ 85c × 7 years	298
	$893

$893 ÷ 7 years = $128 yearly cost
$3,638 — 128 = *$3,500 per year savings.*

After six years operation there is every indication that the bearings won't have to be cleaned again for the life of the machine.

We might take five hydraulic injection molding machines holding 110 gallons of oil each, for which the manufacturer recommended changing the oil every 1000 hours of operation. On a 40-hour week, this would be every six months, in our plant on a 144-hour week it would be every eight weeks. In our case, then, by determining we could run 30,000 hours on an oil change we could expect the following:

Cost per machine per oil change, 110 gals. @ 60c $66
Labor cleaning tank, disposing oil, trucking, etc 14

$80

MANUFACTURER'S RECOMMENDED PRACTICE
5 machines × $80 × 6 changes per year . $2,400 per year

OUR PRACTICE
30,000 hours = 4 years per oil change . $ 100 per year

Saving ..... $2,300 per year

In one department a man spent full time greasing ball and roller bearings. The schedule was changed to once a year with less bearing failures because bearings are not now over-greased.

40 hours × 52 weeks × $1.20 ..... $2,496 per year
8 hours × $1.20 ..... 10 per year

Yearly savings $2,486

Steam condensate return pumps formerly had the oil feeds determined by the oiler. A study of these 124 pumps reduced the quantity of oil from 57 gallons per week to 3 gallons. In addition to this, the amount of oil going to the boiler feed water treatment was reduced by 2,808 gallons per year. On oil alone the following results were obtained:

57 gallons × 52 weeks × 50c = ... $1,482 per year
3 gallons × 52 weeks × 50c = ... 78 per year

Savings per year $1,404

Four older style calenders had sight feed gravity oilers that required six gallons of oil every 24-hour day. After the oil went through the calenders it was used for squirt can oil. A filter was put in the basement and the filtered oil was pumped up to a gravity tank to be recirculated through the calenders.

6 gallons × 5 days × (80c-20c squirt can oil) × 52 ..... $ 936 per year
50 gallons × 80c ..... 40 per year

Yearly saving ..... $ 896
Cost of filter, tank, piping, etc. .... $ 800

Six machines were provided with only drilled holes to the bearings for hand oiling. These machines ran sixteen hours a day and required an hour and a half for oiling each 8-hour shift. Drive type grease fittings and bottle or wick oilers were installed and the lubrication schedule changed to once a week.

Former cost—3 hours × 6 days × $1.20 × 52 weeks ..... $1,123 per year
Present cost—1½ hours × 52 weeks × $1.20 94

Yearly saving $1,029
Cost of installing fittings ..... $ 480

These few instances add up to over $13,000 per year and the savings go on year after year. One could go on for pages, but the writer has only attempted to show some of the more fruitful sources of direct savings. To recapitulate:

1. The correct oil for a given application (Paper Machine).
2. Proper service life to be expected from an oil (Hydraulic System).
3. Frequency of lubrication (Greasing ball and roller bearings).
4. Proper quantity of lubricants (Steam condensate pumps).
5. Prevention of waste by filters or centrifuges (Calenders).
6. Proper method of application of lubricants (Changing from hand oiling to devices).

No attempt will be made, nor is it deemed necessary, to evaluate the advantages of proper storage, dispensing and application of lubricants. When a great many products are used there are bound to be mistakes and they are costly. One example might indicate how easily they occur. We were using a soap filled (non-drip) oil in a department that had some old lathes and drill presses that required hand oiling. This lubricant worked well, and as a result when a man noticed the flywheels of some punch presses throwing oil, he applied this oil. Unfortunately, he did not know that non-drip oil had a soap bodying agent in it, nor did he know that the flywheel had a felt wick oiler to the clutch mechanism. The soap plugged the felt and we overhauled some forty presses. What little oil we saved in the tool room was costly on the punch presses. These kinds of mistakes are made in good faith and it is hard to blame the employee who is trying to be helpful. It is best to prevent those mistakes by minimizing special products that may cause trouble if misapplied and to educate those responsible to proceed through regular channels.

Lubrication and Design of Equipment

As the lubrication engineer gains experience and knowledge, he is in a most favorable position to analyze machine failures. When a machine failure occurs it is always a question as to whether or not it was lubricated properly. Only a thorough understanding of lubricants and the principles upon which they work will enable one to answer this part of a machine failure. We all have seen many cases of where one has vainly sought for some mysterious property in a lubricant that will insure continuity of service. This is expensive as failure after failure will occur unless conditions are made conducive to lubrication.

The knowledge gained in the study of the performance of lubricants, methods of application and machine weaknesses can be applied profitably to equipment you may be marketing or machines you may consider purchasing. We have found it necessary to have a lubrication engineer[1] work 100 per cent of this time with our machine designers and those responsible for the purchase of mechanical equipment. One has to master the principles of lubrication and machine design before he can contribute to a well designed mechanism. The lubrication engineer should be able to analyze machine design for choice of bearings, finishes, clearances, choice of materials and ease of maintenance.

Inspection and Preventative Maintenance Program

The lubrication engineers should assist in scheduling inspection and overhauling of equipment. This will include seeing that oil samples are procured from important systems periodically and interpreting the results. This is an important and profitable part of his work. Equipment manufacturers only make very general recommendations in regard to the operation of this equipment. Your operating conditions will determine the modifications that are required. One example might indicate the importance of carefully reviewing the recommendations. A continuous centrifuge had a rotating planetary gear case for which the instructions called for filling two-thirds full of oil. When the transmission came up to speed, centrifugal force threw the oil to the

[1] *W. T. Everitt, Asst. Lubricating Engineer, Director A.S.L.E., Eastman Kodak Co., Rochester, N. Y.*

outside and there was no oil in the center. This condition caused failure of the pinion bearing and wrecked the transmission. A consideration of this condition would have saved $3,800. When we wrote the manufacturer of the equipment, he advised an E. P. gear lubricant which would not have alleviated the condition an iota. Manufacturers of equipment are often helpful, but many times, especially on new models, do not have as much experience as you do, and therefore you should not hesitate to make such changes as your analysis dictates.

The Lubrication Engineer

We have outlined some of the savings to be made through proper lubrication engineering. We should realize that in order to effect these savings, changes must be made in expensive machinery or in the method of operation. Some of the requirements for a lubrication engineer are as follows:

1. A thorough knowledge of the theory of lubrication.
2. Familiarity with products available.
3. A knowledge of the materials of construction, finishes, clearances and principles of machine design.
4. He should also have sufficient personality to obtain cooperation and be able to meet technical people.
5. He must have imagination to visualize the scope of his job, and initiative to carry out improvements.

Management Responsibilities

When management decides that they should have lubrication engineers they should base their selection on an individual that has the potential ability of becoming a first-class engineer, and one that will inspire confidence in all those he will work with. They will have to select a man that requires very little direction. They should be prepared to invest in his training as the field is broad. One of the best educational programs is attendance at technical meetings to become acquainted with new development and people that can discuss mutual problems. Starting from scratch a good return on the investment in lubrication engineers should be realized in three to five years. This may seem a little slow, but one must realize that the lubrication engineer must acquire a working knowledge of a highly technical subject. He must learn the organization, policies, and responsibilities of everyone he comes in contact with. He must know thoroughly every piece of mechanical equipment and the conditions surrounding its operation.

Discussion

In the discussion period following the presentation of the formal papers, Mr. E. J. Ehret, of the Farval Company confirmed the type of savings and economies outlined by Mr. Pope and indicated the need for furthering the whole subject with management. He further cited instances where by the proper coordination of selection of proper lubricants, storage, seals, filter systems and automatic lubricating devices, bearing life in the steel industry has been increased six and eight hundred per cent, thus translating lubrication into dollars and bringing to management the knowledge that the Lubrication Engineer can contribute as much as any other department toward efficient and uninterrupted production.

Mr. C. S. Bullions, of the Socony Vacuum Oil Company, intimated that because of expansion of industry in general both here and broad, the demand for vitally necessary lubricants exceeds the supply. He stressed the necessity for conservation of lubricants as part of a lubrication engineering program. A great necessity exists for the development of more men for responsible positions in the plants to have full charge of lubrication and to coordinate their efforts with the general staff to meet the more complicated mechanical problems that have developed over the past few years.

Mr. C. E. Pritchard, of the Republic Steel Company, pointed out that although the speaker was connected with a film and camera manufacturing concern, and the commentator with the steel industry, they had many parallel problems. In discussing Mr. Keen's paper, Mr. Pritchard stressed the need for closer cooperation between the machine manufacturer and machine user. He suggested that more follow-up in the field would be welcomed by the user, and would be a means of incorporating the results of user's experience into the design of new machines. He further brought out the fact that new designs in machinery have included automatic or semi-automatic lubricating systems necesstating the development of higher caliber men in charge of lubrication and maintenance. He also stressed the need of scheduling lubrication application and oil removals as an aid in reducing man hours.

Mr. Frank Ross, of the E. F. Houghton Company, stressed the need for closer cooperation of machine builders and users and suggested the formation of a committee to work with machine builders.

Mr. H. R. Hager, of the Sun Oil Company, brought out interesting comparisons of costs of machines and lubricants and suggested that cost figures from experience in different plants be used as material for future discussion.

Mr. Oscar Frohman, of Ampco Metals Company, stressed the importance of cooperation between the scientist, the physicist, the research chemist and the man in charge of application in the plant. The importance of discussion in Sectional Meetings of mutual problems was followed with a description of the benefits to industry of the lecture programs that have just been completed.

Mr. Frank Denshy, of General Electric Company, urged that the lubrication engineer be given more knowledge of machine design and cited some very interesting facts regarding the down-time of machinery.

Mr. William King gave some interesting information regarding lubrication and maintenance, and the benefits derived from the creation of separate departments.

Mr. Lee Smith, of the Pittsburgh Consolidated Coal Company, gave the viewpoint of the Coal Industry, citing the problems peculiar to the mobile equipment required in mining coal, the effects of contamination by coal dust and the means taken for efficient lubrication.

Mr. J. Slomer, of the Goodman Manufacturing Company, elaborated further on the preceding remarks, giving the viewpoint of the manufacturer of mining machinery, stressing the point that expert attention was needed in its care and maintenance and the proper selection of lubricants.

The meeting was closed with a summation by President O. L. Maag, who brought out the value of these sessions not only to the participants but to industry in general.

Latest Trends in Machine Tool Lubrication

By J. R. KEEN
Gisholt Machine Co.

WHEN a business firm purchases a new machine tool, the primary interest is in the productivity of the machine. All management authorizations of such capital expenditures are predicated on the assumption that this productivity will be uninterrupted by failure of machine function. Purchase of the machine from a reputable manufacturer insures against failure of machine function from the standpoint of design, material and workmanship, as this is wholly the manufacturer's responsibility. However, interruption of production due to faulty lubrication is often overlooked by the purchaser as a possible hazard. The machine tool manufacturer has discharged his responsibility in this respect when he makes provision for an adequate means of lubrication, and furnishes detailed instructions outlining the type, grade, and quality of the various lubricants and the proper location and frequency of their application. How closely these instructions are followed, is dependent entirely upon the new owner's attitude toward the problem of successful machine tool lubrication.

A better understanding of this problem can best be obtained by reviewing the development of the present day, highly productive machine tool. This development can be divided into three distinct phases, corresponding roughly to the types of cutting tools then available to industry. During the first phase, carbon steel tools then in common use necessitated relatively low spindle speeds. Power was supplied to the machine by means of leather belting from overhead line-shafting, counter-shafts and cone drives. Spindle bearings were usually plain bronze boxes lubricated by sight-feed oilers. The most common provision for lubrication of secondary bearings consisted of a small drilled hole carrying oil to plain bronze bushings. Due to metallurgical limitations, large bearing areas were necessary to keep bearing pressures to an absolute minimum. Grease cups were sometimes used to carry grease to a slow speed bearing; however, no oil seals or retainers were provided to prevent the loss of lubricant or the entrance of foreign matter. One might properly ask how could these machines be operated successfully for many years with so many obvious lubrication faults! The answer lies in the basic slow speed operation of the machines, the frequency of lubrication and the fact that they were operated by experienced master machinists who knew how to care for mechanical equipment.

The second phase of machine tool development coincides with the general adoption of high-speed steel cutting tools. As these tools permitted considerably higher spindle speeds and proportionately greater stock removal, proper lubrication became a serious problem. Machine tool builders were soon called upon to supply individual motor drives to all new machine tools. Step pulleys and countershafts thus being ruled out of the picture, spindle speed changes were arranged by means of a gear train enclosed within a gear box or headstock. Higher spindle speeds resulted in the widespread adoption of anti-friction bearings for spindles and other shafts in the gear train and their lubrication by means of an oil bath was found both convenient and adequate. The increased tool pressures possible with high speed cutting tools resulted in rapid wear of the cast iron bed ways, and it was found necessary to increase the bearing areas. This in turn called for much greater attention to proper oil grooving and larger fixed reservoirs.

Machine tool builders, confronted with serious galling of way surfaces, began to experiment with various types and kinds of hardened ways, either by applying strips of hardened steel to the cast iron bed or flame hardening the cast iron way itself. Lubrication engineers, working closely with machine tool designers, developed special purpose lubricants for specific applications, as it was obvious that no one type of oil or grease would be suitable for high speed spindles, the extreme pressures and wiping contact of worm gearing, and the high unit pressure of various slides and saddles. It was soon found, however, that the specification of all these lubricants had its drawback from the practical side. Few shops had recognized the importance of establishing a Lubrication Department with a certain individual, or individuals, responsible for the proper lubrication of all machine tools, and, as a consequence, numerous bearing failures occurred due to the outright neglect of periodic lubrication, or the more easily excusable reason that the wrong lubricant was applied to the wrong fitting. In an endeavor to simplify this problem, machine designers experimented with various means of one-shot lubrication, compromising design for the expediency of using one type of oil for the majority of lubrication points. On certain machine tools with a large number of high speed rotating shafts, and no highly loaded reciprocating slides, this one-shot system proved highly successful and is in common use at the present time. In the great majority of cases, however, this over-simplification did not prove too successful due to the widely divergent requirements for lubrication present in even the most simplified design.

The third phase of machine tool development

evolved from the general usage of cemented carbide cutting tools. These tools permitted spindle speeds up to 6 times those possible with high speed steel, with a corresponding increase in horsepower requirements. Machine tool builders soon found that their machines were too light, underpowered and inadequately lubricated to exploit the advantages of carbide tooling to its fullest extent. Complete redesign of the entire machine was often the only solution. Tremendous advancements were made in the speed, operating ease, efficiency and productivity of machine tools. In the meantime, small, highly efficient, hydraulic pumps became available along with every conceivable type of valve, flow control and metering device.

In the new designs above mentioned, full use was made of these new hydraulic components. Hydraulic traverse to large, heavy tables, fine feeding movements to tool carrying slides and remote actuation of driving clutches became commonplace. Due to the fact that the simple, high speed, hydraulic pumps depended upon a good quality turbine oil for self-lubrication as well as the hydraulic medium, machine tool designers were quick to utilize this oil under pressure as a means of lubricating various bearings. This was particularly helpful in headstock gear trains and spindle bearing applications as the oil bath means of lubrication caused the over-lubrication of the new high speed anti-friction bearings. The resultant foaming of the oil caused destructive temperature rises in these precision bearing applications.

The development of cartridge type oil seals to contain oil under pressure was a great step forward; however, these oil seals would often eat into and burn up a rapidly rotating shaft. It was puzzling to see a relatively soft composition seal wear deep grooves into a hardened shaft; however, it was found that minute particles of metal loosened during grinding, would imbed themselves into the composition seal and in turn wear the shaft. This problem was finally solved by superfinishing the oil seal surface of the shaft.

Modern machine tools are now provided with automatic means of supplying metered amounts of oil to slides and carriages by interlocking the lubricating plunger with the levers or controls actuating the slide movement. This system has proven highly satisfactory and has resulted in nearly ideal lubrication conditions without the danger of over-lubrication. Take the turret saddle of a turret lathe, for example. Different machine set-ups call for various frequencies of use of the saddle. By interlocking means of lubrication with the saddle traverse lever, no lubrication is supplied until the saddle is called upon to move, yet each time the saddle does move a metered amount of oil is supplied to the ways.

Most mass production industries with automatic or semi-automatic machine tools have been forced to install lubrication departments staffed with specialists in the art of lubrication, who carry on a periodic lubrication schedule of each machine in the plant, using the correct oils for each specified application. This is due to the fact that these industries hire machine operators who know little or nothing about mechanisms more complicated that a crow-bar. These lubrication departments more than pay for themselves in protection of the plants' capital assets and prevention of production tie-ups necessitated by replacement of burnt up and improperly lubricated machine parts. Smaller shops usually employ a higher class of machine operator or machinist who is more familiar with the proper maintenance of machine tools, and thus the need for a specialized lubrication department is not nearly so critical, but is still very desirable.

All machine tool designers are aware of the importance of adequate lubrication and will oftimes adopt a design incorporating expensive rifle drilling operations, thereby greatly increasing the cost of the machine part, merely to insure a continuous and adequate supply of lubrication. Examine any modern machine tool with a critical eye for lubrication provisions, and you will find numerous labyrinths, oil seals, felt and neoprene wipers, bellows type rubber boots, oil slingers, distribution manifolds, elaborate oil grooving, oil level gauges, and last but not least, adequate oil filters.

Our service files are filled with classic examples of machine tools being ruined by improper lubrication in the customer's plant. Our service men have found sawdust, cast iron chips, stray nuts and bolts, old wiping rags, leather gauntlets, and, on one occasion, even a badly shredded bath towel in the hydraulic and lubrication circuit of our machines.

If all machine tool users would insist on a definite lubrication program, following the machine tool builders' charts and recommendations, establish and maintain a segregated area for the storage of lubricants and the prevention of their contamination, there would be no such thing as a lubrication problem.

Shell Film Clarifies Turbine Lubrication

The Shell Oil Company educational training film, "Lubrication of Turbine Systems," which was produced for the United States Navy Department Bureau of Ships, is now available to all parties interested in the operation of turbines, the company announced recently. The film, a result of extensive research, shows the great advances made during the war in turbine lubrication and uses the technique of both live action and animated drawings.

At the beginning of the war, the company, which had already developed highly stable rust-inhibited turbine oils for stationary units, was requested by the U. S. Navy to develop similar oils with higher specifications for combat vessels. For several years Shell was the only company that could meet these specifications, supplying the greater proportion of the Navy's total requirements of this oil during the last fiscal year.

"Lubrication of Turbine Systems" requires 30 minutes for screening, and is a 16 mm., black and white, sound film. It explains the functions and characteristics of turbine oil in the power plant of a modern destroyer, stressing that it must lubricate, cool and act as a hydraulic medium. Standard laboratory tests are pictured to clarify demulsibility, foam resistance, rust prevention, oxidation stability and other characteristics. Good maintenance and cleanliness are emphasized for long life and trouble free operation of turbine. Commercialism is avoided throughout.

The film begins with views of turbines in builder's shop. Arrangement of a typical pressure circulating turbine lubricating system is shown. Sump, pumps, strainers and coolers are described and illustrated. Purifying system is explained in connection with settling and centrifuging of the oil.

Although industrial power plant turbines usually require lighter viscosity oil, most of the components described in the motion picture are found in land power plants, Shell stated.

Film is now available for general distribution from Shell Oil Co., Inc., 50 West 50th Street, New York 20, New York.

Additives in Lubricating Greases*

By GUS KAUFMAN

The Texas Company, Technical & Research Division, New York, N. Y.

The author stresses the importance of field tests in evaluating greases containing additives, since, he says, additives may not always be compatible, nor do they always have the same properties when used with different type bases. Some of the properties which may be improved by the use of additives in greases are load-carrying ability, greater resistance to oxidation, heat, water, and corrosion, better worked consistency, and improvement in rust prevention.

THE subject of this paper appears to restrict it to a limited portion of grease technology. Actually, since lubricating greases are defined by the American Society for Testing Materials as "a semi-solid or solid combination of a petroleum product and a soap, or a mixture of soaps with or without fillers, suitable for certain types of lubrication," it is seen that this paper could embrace all that is known of greases. This is, of course, not practicable and only a limited portion of this information will be covered, particularly as it applies to the use of additives for improving certain properties of lubricating greases, such as:

1. Ability to maintain consistency on repeated working and/or heating.
2. Ability to improve heat stability.
3. Ability to resist oxidation.
4. Improvement in load carrying capacity; that is, so-called extreme pressure characteristics.
5. Improvement in water resistance.
6. Improvement in rust prevention.

It will not be possible in some cases to be specific in defining the nature and composition of the additives used in view of the fact that many of these accomplishments are of a patentable nature. However, wherever possible specific names of additives have been given.

General Discussion

The simplest grease consists of soap added to oil. Now why do we add other materials to grease? Simply because the soap-lubricating oil compound may not have all the properties desired. At present many different kinds of greases are necessary to successfully meet various lubrication requirements. Additives and special compounding and manufacturing procedures are used, therefore, in an effort to reduce the number of greases to a minimum. Marked progress has been made. For example, in the aviation industry where dozens of greases have been used previously, the entire aircraft can now be lubricated by perhaps four or five greases, and there is a possibility that in the very near future this number may be reduced even further.

Before discussing means for improving the properties of greases by the use of additives and other means, it might be well to discuss some common misconceptions. For example, it is commonly stated that grease making is an art. Certainly it is anything but that. Few people realize that it is an accurate chemical process. Where else do you find manufacture controlled to an accuracy of one part in fifty thousand or one part in one-hundred thousand, and even one part in a million? For example, it is common practice to weigh to an accuracy of one pound or one-half pound in fifty thousand pounds. Then how has the misconception of the "art" in grease making come about? Well, the above statements on accuracy of manufacture apply to the chemical accuracy. However, grease makers must not only reproduce the same chemical compound, but its texture and looks must remain the same from batch to batch, and some art is required to do this. Secondly, since the soap-mineral oil combination results in a gel type of consistency which may change with working and with temperature, grease makers must predict from the condition of the grease in the kettle at the higher temperatures what it will do when it cools in packages. In this connection consistencies are, of course, taken at room temperature; that is, 77F, and it is realized that in actual operation the chances of a grease being required to operate only at this one temperature are very, very slight. This brings up another common misconception: that is, that if the grease is outside the particular specification set for it, whether it be the manufacturer's specification or the buyer's specification, it is no good. Let us look at this a moment; for example, let us consider consistency. The maximum range now used by grease manufacturers is thirty points by the ASTM worked penetration method for lubricating greases. The grease maker must, therefore, predict from the consistency of the grease in the kettle what it will be when it is drawn, and the latter must come within the thirty-point range set up by the classification system of the National Lubricating Grease Institute (NLGI). He must predict from the consistency of the sample taken for control what the ultimate consistency of the grease will be when drawn into different packages at different cooling rates. However, the reproducibility of the test method itself is only ± ten points, the latter figure having recently been obtained as a result of cooperative work done by Technical Committee G of the American Society for Testing Materials. Therefore, the grease maker must draw the grease hot and predict its setting up to very narrow limits. In fact, allowing for the reproducibility of the method, he has only a very few penetration points to work with. If the grease does not come within the thirty points permitted by the NLGI, the grease must be dumped. However, the question that really comes up is whether this narrow penetration range for consistency is important, which leads to the first phase of improvements in lubricating greases which will be discussed.

Consistency

When a new or improved grease is developed, its successful limits of operation are not limited to a consistency range of only thirty points.

* *Presented before the New York Section, A.S.L.E., January 30, 1947.*

In most cases during the development of the product it was found to work satisfactorily over a much wider consistency range than thirty points; for example, fifty points or one hundred points, or even two hundred points in ASTM penetration. The consistency of the final grease is limited to the required NLGI thirty points primarily for greater uniformity and because of mechanical or operational limitations. For example, the particular grease gun available might not handle a wider range of consistency or the particular motor might not have sufficient power to turn if a harder-consistency product were used. The fact remains that the same grease functions from a lubrication standpoint over a wide range of consistencies. Therefore, reasonable limits for consistency are all that are necessary.

Let us see what has been done to "improve" or obtain the desired consistency over ranges of temperature and "workings" (that is, subjection to shear). One goal has been to develop a grease which would not soften after repeated workings or repeated subjection to shearing stresses. Normal greases show a spread of thirty to one hundred points between the ASTM unworked penetration and the worked penetration. Originally the goal was to make these two values approach each other. It was found that certain types of sodium soap greases and even specially prepared lime soap greases would do this. However, this is nothing to get excited about because the ASTM worked penetration represents only sixty workings through a ¼ inch orifice at room temperature which is usually not the operating temperature, but a bearing operating at say 3,600 rpm works the grease over 200,000 times in just one hour and over 200,000,000 times in 1,000 hours, a normal period before relubrication of anti-friction bearings. However, as a result of research in the use of additives and special methods of manufacture, it has been possible to develop greases which show practically no change in consistency with working as indicated by Grease B in Table I. It will be noted that although Grease A has a worked penetration of 285 after the standard 60 strokes, it becomes so soft as to make it impossible to take a penetration after 100,000 workings. However, Grease B. which has a penetration of 287 after the normal 60 strokes, has a penetration of only 288 after 100,000 workings.

The desirability of the above property; that is, maintenance of the same consistency over wide ranges of conditions is manifested by now being required in important specifications. For example, Army-Navy Aeronautical Specification AN-G-15 General Purpose Grease requires that the grease resist working down, permitting a maximum penetration of 375 after 100,000 workings on the ASTM Grease Worker. Although considerable difficulties were first experienced in meeting this rather severe requirement, as indicated above, this is now possible; in fact, Grease B above more than meets the requirement. From a practical standpoint there are operating conditions which require that a grease not work down, in particular where leakage is especially undesirable.

In an effort to obtain a constant consistency after working, grease manufacturers commonly resort to milling, but this may produce only a temporary effect, as is shown in Table II. It will be seen that the ASTM worked and unworked penetrations which are taken at 77F have been brought closer together by milling, but a few minutes of use, as in a ball or roller bearing, nullifies this as the small amount of heat generated causes the grease to revert more or less to its original consistency, and after working in a bearing it acts the same as it would if it had never been milled. Milling of a grease is usually carried out to reduce leakage, but it will be noted in Table II that this was not accomplished, the leakage for the milled grease being, if anything, slightly higher than the unmilled grease.

It must be recognized, however, that there are certain types of lubrication when it may be desirable to compound a grease in such a way as to have it work down and yet not leak out. For example, in certain anti-friction bearing applications it is desired to have flooded lubrication without leakage.

This is possible by the use of proper compounding ingredients, as is shown in Table III. It will be seen that Grease C works down much more than Grease D; yet no leakage was obtained with the former, whereas leakage was very bad with the latter. Grease C did not leak out in spite of the fact that it became very soft, which was possible by special compounding procedures. On the other hand, Grease D softened only slightly; yet gave bad leakage. Grease E has been included in Table III to show that greases can be made with only slight softening and still give no leakage. Inasmuch as the mere resistance to working down is no indication of leakage tendency, the question naturally comes up as to what properties of the grease are responsible for leakage. This subject was discussed in a paper by the author published in *The Institute Spokesman* (NLGI)

TABLE I—CONSISTENCY VS. WORKING (RESISTANCE TO SHEAR)

	Grease A	*Grease B*
ASTM Penetration		
Unworked	265	267
Worked (Standard = 60 Strokes)	285	287
Worked 100,000 times	Too Soft*	288

* Penetration more than 420.

TABLE II—EFFECT OF MILLING ON CONSISTENCY[1]

	Unmilled	*Milled*
ASTM Penetration		
Unworked	195	309
Worked	299	328
Difference	104	19
Miniature Penetrations[2]		
Unworked	54	128
Worked	140	196
Difference	86	68
Miniature Penetrations on Grease after Running on Anti-Friction Bearing @ 1750 rpm — Maximum Temperature 156F		
Original Grease	54	128
Grease on Bearing	41-45	50-62
Grease which Leaked Out	98-100	91-93
% Leakage	17.2-19.0	22.8-23.7

[1] Taken from Paper Presented by Author before National Lubricating Grease Institute on October 4, 1938.

[2] Miniature Penetrometer for Determining the Consistency of Lubricating Greases—Gus Kaufman, W. J. Finn, R. J. Harrington *I.E.C.*, Anal., Vol. II, No. 2—February 19, 1939.

—Volume II — No. 12 — March, 1939. It was pointed out therein that one of the most important properties of a grease which causes leakage is texture. Other factors discussed were air entrainment and vaporization of volatile matter in greases.

Considerable space has been devoted to modifications in greases by the use of additives or by the choice of ingredients to obtain the desired consistency because consistency or changes in consistency is something which appears easy to understand. For that reason an importance has been attached to consistency completely out of line with its real importance. We hear of specifications requiring a ten to fifteen point range in consistency limits, and we hear of grease manufacturers who pride themselves by claiming such narrow limits of manufacture in spite of the fact that the method of taking penetrations itself is only accurate to ± 10 points. I would contend that if a grease must be made to such close consistency limits to function properly, it is no good. Also if a piece of equipment requires a lubricant of such close tolerances, it has not been properly designed. It is agreed that greases should be and are manufactured to close tolerances, but, in addition, they should function satisfactorily over wide ranges of tolerance. In most cases where impractical tolerances are specified for greases, the conclusions have been based on limited test data or inadequate or nonreproducible test information.

Table III—Consistency vs. Leakage

	Grease C	*Grease D*	*Grease E*
ASTM Penetration			
Unworked	255	250	265
Worked	430	275	280
Leakage from Ball Bearing Operating at 1750 rpm	None	35–40%	None
Penetration on Used Grease	Too Soft*	Only Slight Softening	Only Slight Softening

* Penetration more than 420.

Heat Stability

One of the outstanding examples where additives have been successfully used is in improving the heat stability of lime soap greases, generally referred to as cup greases. These are probably the commonest greases made. The soap and oil are usually held together by water, this method having been used since their inception and still being used. However, in use if the temperature rises sufficiently high to vaporize the water, the usual cup greases break down into soap and oil. It is generally supposed that this will occur at a temperature corresponding to the boiling point of water. Actually ordinary lime soap greases will break down after heating at temperatures of the order of 160F; for example, in anti-friction bearings.

To obtain improved resistance to heat extensive research was carried out to determine what additives could be used which would not be lost at the elevated temperature. This problem was successfully solved and is covered by various patents issued and pending. These improved lime soap greases may be heated well above their melting points and above the boiling point of water and still not break down; in fact, they may be heated repeatedly without separating. Figure 1 shows this phenomenon.

Another example of improved heat resistance is the brick type of sodium soap greases as used on open journals where the grease must be solid, must touch the rotating shaft, and yet must not feed out too fast; for example, driving journals of locomotives. In this case, it is desired that the grease be firm to resist deformation and yet. soft enough to permit feeding at temperatures which in the case of locomotives may reach sub-zero. Still the grease must remain firm when the journal heats up to 250F, and even 300F. Figure 2 shows how this was accomplished. Please note that although Grease F was softer at normal temperatures, which is a distinct advantage since it produces immediate lubrication, still it is many times harder than Grease G at elevated temperatures although Grease G was some three times harder than Grease F at room temperature.

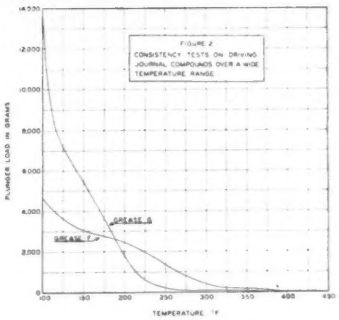


Figure 2.

It will be noted that in the example cited above no reference was made to the dropping points of these products in relation to heat stability. It is pointed out that melting point or dropping point bear no relation to heat stability in practice, which is well recognized by both manufacturers and users of grease. The point is that the melting point or dropping point of a grease is merely the temperature at which one drop detaches itself from the remainder of the grease, using a specified type of receptacle for the grease. In fact, it has been possible to make greases having melting points of 600F and over; yet such products had very poor practical heat stability simply because the product may decompose during the running of the test, and the decomposition products may never drop through to give a true dropping point. Similarly pressure viscosity should not be used as an indication of heat stability since here the product is subjected to heat for only a short period of time and the viscosity of the grease bears no relation to practical heat stability. Here too if the product decomposes, a high viscosity will be obtained, which is, of course, meaningless from a practical standpoint.

Oxidation Stability

Hand in hand with heat stability comes oxidation stability. Advances have been truly beneficial. No little credit goes to the development of a simple accelerated test method to

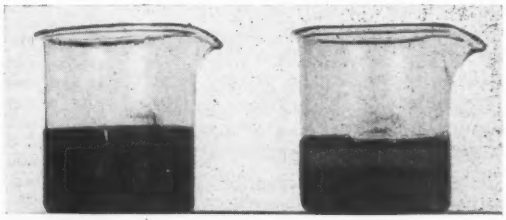


Figure 1. Comparison of stability to heating of heat-stable and non-heat-stable calcium soup greases.

Held for 30 minutes at 250 F. Cooled atmospherically.

a
Heat-stable calcium soup grease.

Ordinary cup grease.

TABLE IV—OXIDATION RESISTANCE—NORMA-HOFFMANN BOMB OXIDATION TEST 210F—110 POUNDS OXYGEN PRESSURE

	Pressure drop, psi	
	100 Hrs.	400 Hrs.
Ordinary Lime Soap Grease	50+	....
Lime Soap Grease Oxidation Inhibited	<5	<20
Sodium Soap Grease	15-25	30-50
Sodium Soap Grease Oxidation Inhibited	<5	<20
Sodium-Calcium Soap Grease	15-25	30-50
Sodium-Calcium Soap Grease Oxidation Inhibited	<5	<20

determine oxidation stability; that is, the Bomb Oxidation Test developed by Mr. F. L. Wright et al.[1,2] The details of this Bomb Oxidation Test method will not be covered in detail in this paper as it is well known to all and is now being considered for adoption by ASTM. Briefly, the bomb oxidation test determines the tendency for a grease to absorb oxygen, and, therefore, is an indication of its oxidation resistance. The grease is subjected in a bomb to an oxygen pressure of 110 psi and a temperature of 210F. The drop in pressure is then observed for different periods of time; a grease showing excellent oxidation resistance will usually have a pressure drop of less than ten pounds and in many cases less than five pounds in 100 hours. Greases showing low pressure drops usually have excellent storage stability.

It has been possible to use additives in greases resulting in marked improvement in their resistance to oxidation. These anti-oxidants are usually of the organic amine type, and only small percentages are necessary to produce these improvements. Table IV shows the improvements possible. For example, an ordinary lime soap grease may show a pressure drop of as much as fifty pounds or more after one hundred hours at 110 pounds of oxygen pressure. However, by the use of oxidation inhibitors lime soap greases can be produced showing a pressure drop of less than five pounds in one hundred hours. In the case of sodium soap greases, lithium soap greases, mixed base greases, etc., similar improvements in oxidation resistance are possible by the use of inhibitors. One point which may be mentioned, however, is that although sodium soap greases made with residual oils, such as wheel bearing greases, may show somewhat high values by the Bomb Oxidation Test, in storage and in use they give satisfactory results.

Regarding the significance of the results, a value of less than five pounds pressure drop usually means that the grease can be packed in a bearing and kept in storage for several years without any deleterious effects upon the bearing. Therefore, better values than this have very little practical significance.

Also, it is emphasized that the Bomb Oxidation Test is intended as an accelerated means for predicting the resistance to oxidation of greases when stored in thin films, for example, on anti-friction bearings or the like; i. e., it is a static test and is not intended to predict practical dynamic performance. A dynamic oxidation test has been developed, and Figure 3 is a diagrammatic sketch of this test. By the use of this type of evaluating equipment it is possible to obtain accelerated oxidation information at about one-tenth of the time necessary with the static test. Before leaving the subject of oxidation tests it should be mentioned that in the early days the bomb oxidation test was run at 175F instead of 210F. One grease which gave entirely satisfactory results at 175F was then found to give very erratic results at 210F. Usually the results were poor. However, in storage under both summer and winter conditions bearings packed with this grease were entirely satisfactory after five years or more. However, this does not in any way detract from the value of the bomb oxidation test to predict storage stability, and its use is widely recognized. Further development work is necessary, however, on the dynamic oxidation test, particularly of an operational nature.

Extreme Pressure Characteristics

In general the extreme pressure (E.P.) characteristics of a lubricant are defined as the ability to carry load or maintain a film of lubricant between the rotating surfaces, thereby preventing seizure under heavy loads. Before discussing the use of additives to improve the extreme pressure characteristics of greases, a means of evaluating these characteristics must be considered. Many machines have been designed for this purpose, and although no one machine is acceptable as measuring and predicting extreme pressure characteristics under all conditions of service, each does serve a valuable purpose for evaluating load carrying capacity under certain specific conditions of operation; that is, although each machine may serve a specific purpose, none correlates with

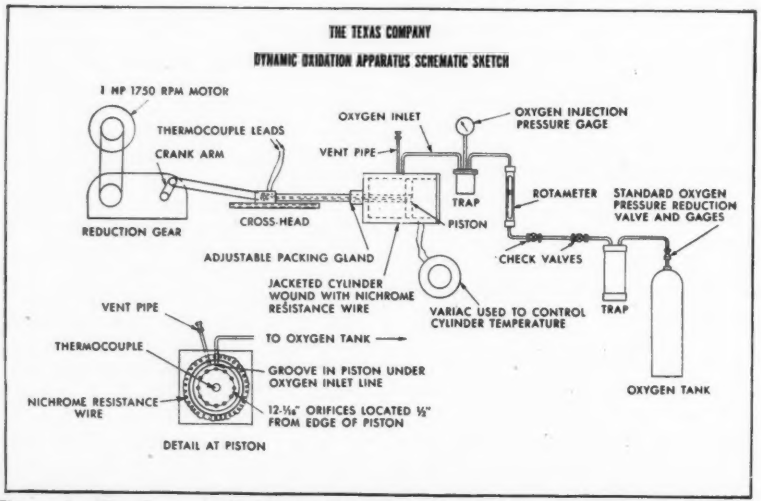


Figure 3. The Dynamic Oxidation Test which is used to distinguish between a grease with poor oxidation resistance and one with good oxidation resistance, also to evaluate the effect of oxidation inhibitors.
The apparatus consists essentially of a modified pump for rapidly evaluating oxidation characteristics of greases by repeatedly spraying grease into an atmosphere of oxygen under controlled conditions of temperature and pressure. This is accomplished by charging a sample of the grease to a closed cylinder equipped with a reciprocating piston provided with orifices, so that the sample is forced constantly from one end of the cylinder to the other. Since the grease is in constant motion, the dynamic method resembles actual service to a greater extent than static tests. Furthermore, the continuous agitation insures intimate and uniform contact between the entire sample and oxygen.

Figure 4. Car entering ford during splash tests.

TABLE V—RESULTS OF INSPECTION OF WHEEL BEARINGS

		Pressure drop lbs. per in.²
Car Name:	Plymouth	Bearing Type: Timken Tapered Roller
Manufacturing Year:	1937	
Model:	Sedan	Amount of Charge: 100 grams
	Right Wheel	*Left Wheel*
Lubricant	*Soda Soap Grease*	*Lime Soap Cup Grease (Water Resistant)*
ASTM Penetration	275	266
Outer Bearing	Small amount of grease on cage. Rollers oily, cup dry. Grease a greenish black color, oil sheen. No evidence of rust.	Very little grease on cage. Rollers oily, cup dry. Grease a yellow color. No evidence of rust.
Inner Bearing	Small amount of grease on cage. Rollers oily, cup dry. No evidence of rust. Grease a greenish black color with an oily sheen.	Very small amount of grease on cage. Grease on cage white. Evidence of water. Three rollers rusty, remainder oily. Three rust spots on cup.

all conditions, and the question of which machine to use will depend upon service conditions and other considerations. For example, the SAE Machine seems to indicate suitability under high speeds and low loads, including shock loads. The Timken Machine appears to indicate suitability under conditions of lower speeds, but higher loads. Also other machines are used, such as the Falex Machine, the Four Ball Machine, etc.

Without going into the advantages and disadvantages of each it might be mentioned that the Timken Machine is probably the most widely used for determining the extreme pressure characteristics of greases although other machines can and have been used. Considering the Timken Machine, an ordinary grease containing no additives; that is, extreme pressure agents, will usually carry a load of only five to fifteen pounds before scoring. By the use of additives and special compounding this can be raised to fifty pounds and more. In fact, it has been possible to obtain values approaching the limit of the Timken Machine; that is, eighty to one hundred pounds. The additives used are usually sulfur, sulfurized oils, chlorinated compounds, sulfur-chlorine treated materials, phosphorus compounds, phosphorus-sulfur compounds, lead soaps, etc. Only small percentages are usually required. In some cases an additive may not itself raise the extreme pressure characteristics of a grease, but in combination with another extreme pressure agent it may have distinct benefits.

Regarding the necessity for extremely high values on the extreme pressure machines, such as the Timken Machine, it is pointed out that even in severe steel mill gear service a Timken value of thirty-five to forty pounds has been found to satisfactorily protect the gears provided other properties of the grease, such as oxidation and heat resistance, are present in the grease. Although values as high as one hundred pounds have been reached on the Timken Machine, it would appear that such values are beyond practical significance, since the metal itself will undergo deformation under such high loads. In addition, the use of trick materials to get these high values usually destroys or causes detriment to the other desirable characteristics of the grease.

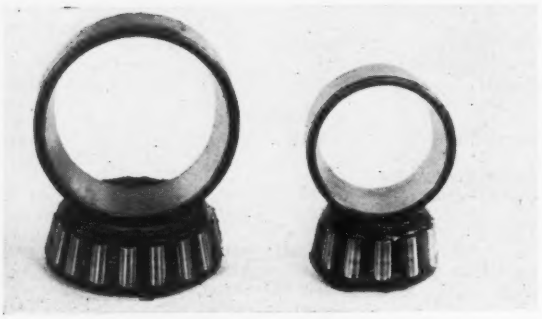
Water Resistance

The user of grease should first analyze his problem and see if he really requires extreme resistance to water washing and whether greases having this property may not have other undesirable properties. For example, it has been shown by both laboratory and field tests that extreme resistance to water washing may also go hand in hand with a tendency towards corrosion and rust formation. It is not difficult to obtain water resistance by the use of special compounding and special additives. For example, lime soap greases are commonly used to obtain water resistance, whereas sodium soap greases are generally considered less resistant to water washing; in fact, when made with many fats, they tend to emulsify with water. However, experiments, carried out with a water resistant grease to which water had been added and with sodium soap, so-called water soluble grease, showed that the bearings packed with the water resistant grease were corroded very badly in less than three months, whereas the sodium soap grease was entirely satisfactory.

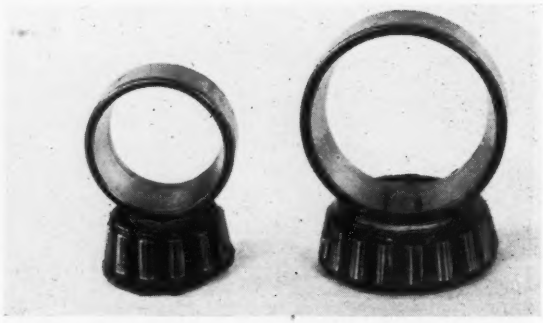
Another soap base giving water resistance is lithium. Also saturated fats give greater water resistance than do unsaturated fats. Fillers have also been used to obtain greater water resistance, but this is generally not recommended due to the abrasive action of most fillers. However, as stated above, the user should study carefully the problem involved before specifying extreme resistance to water washing since the latter is very often a detriment rather than a help.

As an example, a practical test was conducted to determine the resistance of soda soap grease (emulsifiable with water) to washing out of the lubricated parts in comparison with water resistant grease (lime soap cup grease). In the procedure chosen sodium soap grease on the one hand and lime soap grease on the other hand were used as lubricants for the wheel bearings and steering mechanisms of automobiles. The cars thus serviced were subjected to severe splashing tests through a stream which would simulate the worst wet-weather driving. One side of the car was lubricated with the sodium soap grease and the other with the lime soap or cup grease. The cars chosen for the work had odometer readings of 25,000 miles, and the original grease seals were used. For the actual tests the cars were driven through a gravel bottomed ford across a fast moving stream. At the time of the test the water was about 15 inches deep, above the running boards of the

Figure 5. Tapered roller bearings after splash test.



Soda soap grease—right front wheel.
Inner bearing assembly. Outer bearing assembly.



Lime soap grease (water insoluble). Left front wheel.
Outer bearing assembly. Inner bearing assembly.

TABLE VI—EXAMINATION OF DRAG LINKS AND TIE RODS

Car Name: Pontiac	*Part Lubricated: Drag Link*	
	Right End	*Left End*
Lubricant	Soda soap grease	Lime soap grease Cup grease
ASTM Penetration (Original)	211	199
Color of Lubricant	Greenish black, oily sheen	Light tan
Texture	Fibrous	Mush like
Appearance of Enclosure	Excellent	Rust present
Exposed Sides	Oily	Dry and rusty

Car Name: Plymouth	*Part Lubricated: Tie Rod*	
	Left End	*Right End*
Lubricant	Soda soap grease	Lime soap grease Cup grease
ASTM Penetration (Original)	211	199
Color of Lubricant	Dull brownish color	Light tan
Texture	Fibrous	Buttery
Appearance of Enclosure	Excellent	Some rust
Exposed Sides	Some grease and oil; no rust	Dry and rusty

cars. The ford was approximately 30 feet across. Each car was driven into the water at 15-20 miles per hour, the underside of the chassis being completely wet. Figure 4 shows one of the cars crossing the ford. The test consisted of ten trips across the creek and ten trips back. After this splash bath the cars were driven seven miles and allowed to stand for one week untouched. Results of the tests on one of the cars are given in Table V and in Figure 5. It will be seen that the soda soap grease lubricated bearings were well protected with no evidence of rust, whereas, those serviced with the water insoluble cup grease plainly showed rusting. It will also be noted that the wheel bearings lubricated with the sodium soap grease still had considerable grease left on the bearings; in fact, more than with the water insoluble lime soap cup grease.

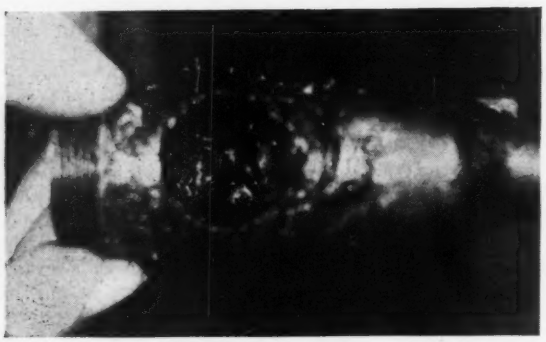
Similar results were obtained on the drag links and tie rods, as given in Table VI and Figures 6 and 7. The soda soap lubricated ends of each part are full of lubricant with no trace of rust present, whereas those ends containing cup grease have some of the grease actually washed out and parts of the assembly showed considerable rust.

In other words under severe water conditions the sodium soap grease, which is more or less water soluble, supplied more and better protection to the tie rods and drag links than did the water resistant grease. Also the sodium soap grease offered superior lubrication to the wheel bearings than did the water resistant grease.

Rust Prevention

Especially during the war period, where conditions of operation were entirely different from normal peacetime operation, conditions of service existed where greases having rust preventive properties were necessary. It is well known that in war operations emergencies necessitated that entire equipment be immersed in water. Of course, such conditions as these do not exist in peace-time. However, considerable progress has been made in the use of additives to

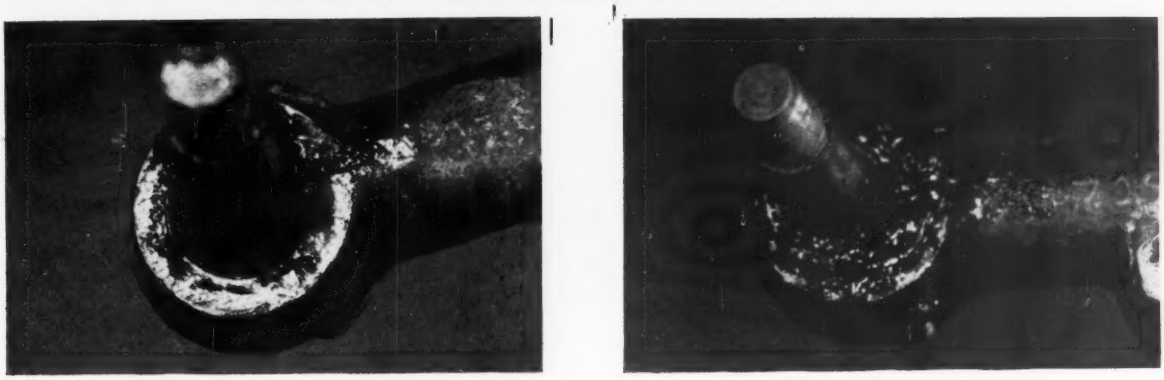
Figure 6. Effect of water on grease-lubricated drag links. Pontiac drag links.



Left end—Cup grease(water resistant) lubricated.

Right end—Soda soap grease lubricated.

Figure 7. Effect of water on grease lubricated tie rods. Plymouth tie rod.



Right end—Cup grease (water resistant) lubricated. Left end—Soda soap grease lubricated.

improve rust prevention. Of particular interest are the sulfonates, lead soaps, emulsifiers, etc.

Some government specifications are now requiring rust protection; for example, Naval Ordnance Specification OS-1350 General Purpose Grease requires that the product pass a salt spray test, wherein a panel coated with the grease is subjected to salt spray for one hundred hours. By the use of special additives it is possible to meet this requirement. Army Ordnance Specification AXS-1169 Artillery Carriage Grease OD No. 00 also requires that the product pass this salt spray test: that is, no rust after one hundred hours at 95F.

Conclusions

Although it is possible by the use of additives to obtain a grease of almost any desired characteristic, it is stressed that many times the obtaining of this property may result in certain non-beneficial effects which may more than offset the benefits desired; that is, although it is possible to obtain a desired property by the use of a particular additive, other important properties of the grease may thereby be destroyed. Therefore, full evaluations and field tests must always be carried out to determine the overall significance of any indicated improvement by the use of additives. Another point is that the different additives required to produce the desired properties may not be compatible, and while one additive might produce the desired property with one soap base grease, it may not necessarily work with another soap base grease. Therefore, the incorporation of each additive necessitates complete re-evaluation for proof of quality.

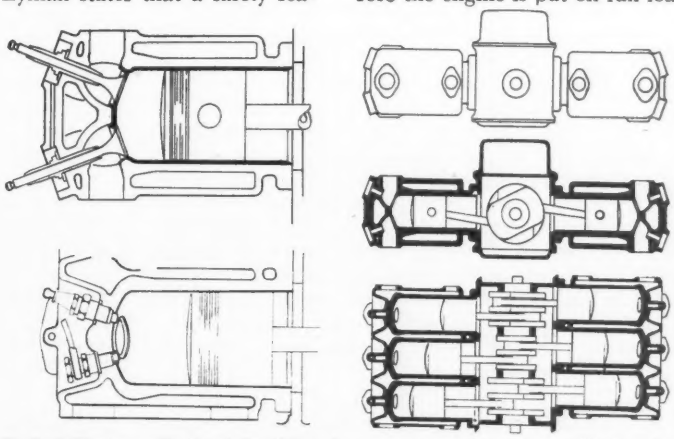
[1] F. L. Wright & W. A. Lutz, *Product Engineering*, June, 1936, P. 210.

[2] F. L. Wright & H. A. Mills, *ASTM Proceedings*, Part II, 38, 525 (1938).

Tucker Engine Has Novel Lubricating Features

Details of the Tucker engine to be used in the new Tucker torpedo automobile have been released by Mr. Kenneth E. Lyman, Technical Advisor to the President of The Tucker Corporation. Mr. Lyman states that the engine is a six-cylinder offset, flat opposed aircraft-type power plant with the oil pan mounted on top of the crankcase so that a dry sump is utilized. The crankshaft is a six-throw unit with four main bearings. Mr. Lyman states that the engine develops 150 horsepower at 1500 revolutions per minute and utilizes fuel injection and high frequency ignition to obtain high torque capacity at low engine speed. Lubricating oil pressure is 50 psi using SAE 10 grade oils. The Tucker Corporation claims improvement in control of quantity of oil in circulation because of the use of the dry sump and states that this makes possible less frequent attention to oil levels. Temperature of the oil is controlled thermostatically at a constant temperature above 210 degrees Fahrenheit, which the Tucker Corporation states increases the thermo and volumetric efficiencies and reduces sludge because of the elimination of water condensation.

A filter is incorporated as an integral part of the oil pan casing and no outside fittings are necessary. Oil level is maintained in an auxiliary reservoir, which is also an integral part of the oil pan, to maintain a predetermined level. A novel feature of the engine auxiliaries is that no parts outside of the engine require lubrication or makeup of oil. Mr. Lyman states that a safety feature is provided in the use of a hydraulic valve actuating mechanism since when lubricating oil pressure fails, the valves will no longer operate and the engine cannot run. A combination starter-generator is used, directly connected to the oil pump such that oil is circulated just as soon as the starter is energized. Mr. Lyman points out that this arrangement makes for the establishment of satisfactory lubrication before the engine is put on full load.



The Tucker Engine. At the left above is a cross section of a cylinder showing valve arrangement; below, a cross section showing the injector and spark plug. At the right, from top to bottom, are an elevation, elevation in cross section, and a plan view.

Specifications -- Their Use and Misuse*

By MELVILLE EHRLICH
American Lubricants, Inc., Buffalo, N. Y.

Brand names, says the author, are not a completely sufficient basis for purchase of lubricants, because factors other than the performance of the lubricant become involved, and because the specifications of a branded product may be changed. Changes are most probably improvements, but may not improve use or cost in special applications.

On the other hand, specifications also have their limitations. Policing is expensive, especially when small quantities are involved, and close adherence to the letter of a spec may preclude use of entirely suitable materials.

The principal fault in the use of specs for lubricants are "related to the dangers inherent in specifying exactly items in which our state of knowledge approaches ignorance."

MY subject, as you know, involves specifications! And since this meeting brings together a group of lubrication engineers, it may not be too hard to discern that the subject concerns more particularly, lubricant specifications.

Allow me to be still more specific. At the recent meeting of the ASTM in Buffalo one symposium, which occupied two afternoons, concerned "Oil Procurement Practices." Behind this fancy phrase, was hidden a conflict—both basic and serious—since conflicts, as we see between management and labor today, lead to bad blood, and that in turn to bloodshed, before compromise is even considered. Yet is not the end result practically the same as could have been achieved before tempers were permitted to rise?

Such is the case with lubricant procurement. Our conflict concerns the use of specifications by consumers in their purchase of lubricants. Oil companies generally don't like the limitations imposed by the use of specifications. Consumers generally feel that lubricants can be bought for less money over all, if specifications are used. The question appears to involve a tool whose nature we should try to investigate before we can look for common ground. Specifications, like porcupines, have their good and bad points, depending on which one is the porcupine. It is my personal feeling that specs are inevitable—that trying to stop them today is as realistic as trying to stop television.

Oil specs have been used for many years. At the ASTM Symposium,[1] Mr. McCloud[2] cited a Ford Motor Co. spec on engine oil, dating back to 1916 and still in use today. The number of specs on lubricants has increased, and got a lift from Government procurement during the late war. At present, specifications are more numerous than ever. And in the purchases which one oil company makes from another we use specifications. So I doubt that we can either deny or turn back the established trend.

And why should the trend be expected to reverse? Specs set a definite basis for control of the grade of a lubricant. The SAE grades—10, 10W, 20, 20W, etc., for motor oils, and 80, 90, 140 and 250 for gear lubes; the NLGI grades for greases numbers 0 through 5—all are well known and respected. These are grades established by specifications based on simple laboratory tests. Such specifications afford signposts for the purchasing department; guides and safeguards for the engineers and designers who must know the lubricants; and markers which limit the freedom of the producer, but by the same token keep his quality control department on its toes. Without specifications, each consumer lab must use its own judgment as to what is reasonable tolerance in successive batches. Under such conditions the burden of purchase must fall increasingly on the laboratories themselves, unless all purchase is to be made solely on the basis of brand name and the supplier's recognized integrity, as was preferred for example by Mr. Voshell[3] at the aforementioned ASTM meeting.

This brings up a highly controversial question: Is brand name a completely sufficient basis for purchase? For a number of widely recognized reasons, the answer would appear to be negative. Some of these reasons involve personality, as in the case of the very earnest, helpful, likeable fellow representing one company, versus Mr. Beer-Belly-Breath himself working for a competitor. Services such as rapid delivery, or the quick appearance of a competent engineer in case of trouble—these often count more than brand name. The history of a lube engineer or salesman's recommendations may make or break a brand name in any plant. As witness cases we have seen—where hot running bearings were lubricated with what was claimed to be the world's best cup grease—only to run hotter because cup grease was misused; or the case where heavy fibrous grease designed for high temperatures but low speeds is used on high-speed, hot-running bearings, with the inevitable result that bearings run hotter. Such poor recommendations will

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** As presented to the Buffalo Chapter, American Society of Lubrication Engineers, June 27, 1946.*

[1] *ASTM 49th Annual Meeting, June 24-28, 1946.*

[2] *J. L. McCloud (Ford Motor Co.) "Oil Procurement in an Automobile Plant."*

[3] *B. C. Voshell (Socony-Vacuum Oil Company, Inc.) "A Recommended Practice for the Purchase of Lubricants."*

supersede brand name in importance in the mind of any plant maintenance engineer.

And of course, the product sold under a brand name may be changed at any time, without notice to the consumer. I do not intend to imply that such change is always bad! In one case a well-known motor oil had anti-oxidant, then detergent added gradually over a period of time. The result—a great improvement! But what of a consumer whose application (not in a gasoline engine) precludes the use of additive-type oils? He wasn't informed of the change! Or consider the wheel-bearing grease whose improvement was the object of much research—yet whose formulation had to be carried out with an eye to making any change in appearance so minute that the purchaser wouldn't notice any change. Perhaps in some non-wheelbearing applications the new grease will prove less suitable. Such change—without warning, even though the change be for the better, is characteristic of brand-name products in general, not lubricants alone. It is less possible when the same items are purchased under specification.

A final blow to purchase by brand name alone is the recognized fact that not all products of a given reputable company are equal in quality. One company has for years marketed a gasoline of unquestioned excellence, and a motor oil as widely acknowledged to be poor. One manufacturer makes a fine refrigerator but a poor radio. And so it goes!

We have observed that specifications are being used more and ever more widely—to establish definite limits and controls on grades of lubricant purchased; and that specifications do offer some advantages, particularly to the purchaser! Fine! But are there not pitfalls?

Lubricant specs are not always safe or applicable. By their very natures they are useful only to large purchasers. Let us remember that any specification consists of a listing or a description of from several to many items, all of which must be tested. The cost of such testing will be identical if the amount involved is five gallons or 5000 gallons. On a simple specification, a reasonable estimate of $5 might represent cost of testing alone. Suppose then that the manufacturer were asked to make up a special order for five gallons of lubricant under this spec. Five gallons; five dollars. Testing alone would cost $1 for each gallon—quite prohibitive! Raise the size of the order to 1000 gallons and the same test cost is diluted to ½¢ per gallon. Obviously such a test system cannot be used unless the purchase is large enough.

And to make this situation still more expensive, specifications are like laws—they are respected only if enforced. This requires the consumer to check at least occasional batches by setting up his own lab and hiring a trained petroleum chemist, or by using a commercial lab to police shipments. And amusingly enough, the small user, to whom these costs are prohibitive, is exactly the one who should carry on such policing, since, as was brought out a moment ago, test costs in large batches, such as are supplied to large consumers, are spread so thin that the producer has no incentive to hold back.

A further cost inherent in the use of specifications is due to an implied shift of responsibility. When the lubricant supplier recommends a definite lubricant for a definite purpose, the lubricant must perform. But what happens when oil companies are simply given specs on which they must bid? Low price wins! Then if the lubricant does not perform properly? The supplier need only prove that his product meets the specification. Beyond this point responsibility rests with the purchaser.[4]

As protection then, the consumer appears to have two alternatives. He must hire a lubrication engineer to solve his problems, or he must re-write the spec to make the supplier responsible for the performance of the lubricant. We all know that an honest supplier cannot accept this burden, since no lubricant is better than its application. Since the supplier of a specification oil has no control over lubricant application, this alternative loses its effectiveness, and the consumer comes down to only one procedure capable of success. If he wishes to purchase strictly by specification, he must back these specifications by hiring his own lubrication engineer. In this case the cost of lubrication engineering is shifted—from the oil supplier to the consumer. A small user cannot possibly afford this!

Other limitations are inherent in the use of lubricant specs. Oftentimes a lubrication engineer who gets into many kinds of problems in all types of machines in ever-so-many different industries, can offer a novel solution to a tough lubrication problem. But what if the lubricant recommended by an oil company engineer for this application is not covered by any of the consumer's existing specifications? Or what if a lubricant on the spec list does cover this application? The lube engineer has recommended himself right out of business! Any company whose rules regarding purchase by specification and bid are too rigid, will find that it often "misses the boat" on lubrication because the lubrication engineers of the lubricant suppliers are not likely to be calling to offer their advice, where they know that business cannot result from their efforts. Specifications may thus decrease the opportunities otherwise available to a consumer, to use the know-how of the oil companies. And with very few possible exceptions, the oil company men "get around" more.

The principal faults in the use of specifications on lubricants are, however, related to the dangers inherent in specifying exactly, items in which our state of knowledge approaches ignorance. Here we find two phases in which our knowledge is sadly lacking.

The first of these gaps in our knowledge relates to what might be called the inherent exclusiveness or "snobbishness" of any specification. For implied in a specification is a thought that only the specification limits called for are suitable for the application in mind. This is a fallacy—but it exists, and should be recognized. A few examples may illustrate this point.

An automobile manufacturer whom we may identify as A, specifies that the wheel-bearings in his cars shall be lubricated with a grease of penetration 265 to 295. The bearings in his wheels are manufactured by a company—call it B—which specifies that the grease used in these bearings should have a penetration of 250 or over. But at least one large-scale supplier of greases has for years turned out a grease of under 250 penetration. Supplier C then recommends for B's bearings, in A's cars, grease which neither A nor B will approve—and with a remarkable record of successful performance. And B, who would like to see grease of penetration—say 260 used in the bearings he makes, finds that C will not supply the grease—it is too soft; and A will not use the grease—it is too hard.

Sounds crazy, doesn't it? I know some of you may argue that this is a misapplication of specifications. And it is! But such misinterpretation is inherent in specifications. The P. V. Machine Co. specifies in its handbook that only Colonel Hooper's Super Duper Blooper Oil No. XYZ is suitable for its machine. Is

[4] *Dantsizen, "Purchasing of Petroleum Oils by the General Electric Co.," presented at the ASTM Symposium on Oil Procurement Practices*[1].

not the implication that no other oil will do? Perhaps this was not the intent of the writer of the spec. But the reader of specs and user of specs see and follow this snobbish exclusiveness—intended or not.

Is the situation any different then, when we read that a specification for hydraulic oil calls for the viscosity to fall between 300 and 315 seconds SUV at 100 F? Is not the implication that 295 sec. is too low and 320 sec. is too high? Yet a hydraulic system on which 300 second oil is specified is being satisfactorily lubricated with 200 second oil heavily loaded with additives (supplied by a company whose name I blushingly refrain from mentioning). If the oil to be purchased for this machine had been purchased under a specification, the 200 second oil could not have been used, and an associated problem which was so licked, would still plague the machine user!

Is there any solution to this exclusiveness? Yes—if we use copious numbers of explanatory notes. And such notes will be forthcoming as we learn enough about lubrication to feel certain that general statements will be accurate. We might, for example, find a specification headed Hydraulic Oil and then a general comment along the line that: "hydraulic oils commonly used in industry range from about 150 to 500 seconds at 100 F SUV and vary in quality from high to low. In this specification it is intended to limit the viscosity (to 300 to 315 seconds) since this permits using the oil as a compromise in equipment in which oils of as high as 350 sec.—or oils of as low as 250 sec. might be preferred. If a wider viscosity range were permitted, the validity of this compromise might be impaired."

Or under carbon residue we might find the limit 0.02% max. and then the comment: "since it is desired to limit oils supplied under this specification to high quality materials, the carbon residue is specified here as 0.02% maximum. This figure is not in itself significant, but in conjunction with the other phases of the specification should lead to the supplying of oils solvent treated and/or filtered to a degree compatible with quality and stability. Should additives in the oil cause increase in this value, a potential supplier need but prove that the additive is of value, and that the base oil without additive does fall within the limit set here, and that supplier's oil will be accepted with a carbon residue as determined by inspection."

Such comments will make specifications long-winded. But they will indicate the spec. maker's good faith rather than desire to exclude competing brands, as often now seems the case. And lubrication as a science will advance to new heights. If no valid reason exists for a narrow viscosity range a reasonable spec. might say: "viscosity: 'the actual viscosity to be supplied shall be stated by the potential supplier as a given value plus or minus 3%, which might be for example 300 sec.±3% or 291 to 309 sec. In no case shall the material offered fall outside the range of 250 to 350 sec. at 100 F SUV'."

The supplier is thus permitted leeway where leeway is not undesirable; and he may then submit bids on standard items, helping his cost and inventory system immeasurably. Do you know that a typical lubricant supplier may carry on his books low-priced engine oils of 100, 150, 170, 185, 200, 220, 250, 275, 285, 300, 315, 325 and 350 seconds viscosity—about half of them because somebody wrote a spec 5 or 10 points different from the rest? And yet on the SAE motor oil basis, only three classes would be represented among these thirteen oils. The situation has achieved the heights of comedy—in a tragic sort of way!

And even more dangerous is an attempt to establish in words and numbers quality standards which we do not know how to state in words and numbers. This situation is particularly hot right now because of improvements in motor oils. Here we find a drastic change from standards which establish grades, to standards which establish quality. And the grave dangers inherent in this change are many.

The catch is, we don't even know truthfully and accurately what a lubricant is. How then can we define quality?[5] This is the phase of specification writing that scares lubricant suppliers half to death. We know that a definite product builds up a history of satisfactory lubrication in a certain application. So we recommend it! But without telling the actual formula and process of manufacture (and to do so would put us out of business) we ourselves can't always tell you why the lubricant is so good. We just know the record of performance. If you want to write a specification for many materials of this type, we couldn't help. Physical factors such as viscosity, flash, pour, etc. help to define it. Chemical factors such as presence and amount of sulfur, phosphorus, chlorine, barium, calcium, sodium, etc.—they help to define the lubricant. But until field performance tests are carried out the exact answer will not be known. This is too expensive to be practical. We try therefore to set up test equipment which indicates something related to quality or performance. We correlate and design, and re-correlate and re-design, and re-re-correlate. When such tests—accelerated or simulated performance tests—are thoroughly correlated, they permit us to establish at least one phase of quality.[6]

But in this field we have only begun to crawl. And for us to write specs on how to walk before we have learned to crawl, is not only futile—it is dangerous, in that the wrong test, or the right test used in the wrong place, will prove a definite bar to progress!

It appears to be time for this to come to an end, and a summation is in order. We are looking for common ground—and that ground may be easiest agreed upon if stated as a goal. All of us are working to one end—lower maintenance cost. One tool used in attempting to achieve this aim is the setting up of specifications which permit the actual lubricant to be bought for less money. If the purchaser is large enough to buy in volume, and has a lubrication engineering staff which includes a test lab, specifications should permit lubricants to be purchased more easily, described more accurately to the engineers who will use them, and maintained in grade.

However lubricants specified without consultation with competent engineers, which are purchased at rock bottom prices without continuous policing (and that adds to hidden costs); lubricants whose method of purchase and application do not permit the use of the accumulated experience of oil company engineers; lubricants whose specifications attempt to define quality, but due to our insufficient knowledge just open the gates to chiseling, or place a ceiling on quality and a bar on progress — these lubricants because of their purchase through specifications, may result in lower lubricant cost but higher overall maintenance cost.

The argument is on the table, gentlemen—may it be solved without bloodshed, as only so can we attain the goal common to all of us.

[5] *C. L. Pope, "Eastman Kodak Purchase Specifications for Lubricants," ASTM Symposium[1]. Note: "This, of course, is a confession that we do not believe we can write a practical specification that will control quality and performance...."*

[6] *J. T. Hendren (Pan-American Airways, Inc.) "Airline Oil Procurement Practices," ASTM Symposium[1].*

A. S. L. E. Holds Second Spring Meeting

THE second Convention of the Society was held Monday, Tuesday and Wednesday, March 17th, 18th and 19th, at the William Penn Hotel in Pittsburgh. A fine program had been prepared by the Program Committee and all of the Sessions were well attended, with a registration in excess of 400 at the Convention.

The last issue of LUBRICATION ENGINEERING carried the complete program, so that it will not be repeated here. The papers given were real contributions to the literature of lubricating engineering.

Everyone had a fine time at the Smoker and Luncheon and Banquet meetings, and the opportunity of good fellowship and interchange of ideas under conditions of pleasant relaxation was welcomed by all.

Three interesting plant trips to the Aluminum Company of America, the Carnegie-Illinois Steel Corporation and the Westinghouse Electric Corporation, were enjoyed by many of those in attendance.

Following the Technical Sessions on Tuesday, March 18th, the following new Directors of the Society were elected for two-year periods: C. A. Bierlein of the General Motors Corporation; W. T. Everitt of the Eastman Kodak Company, and E. M. Kipp of the Aluminum Company of America. At the meeting of the Industrial Member Representatives, C. E. Pritchard of the Republic Steel Company was elected a Director, representing the Consumer Group interests, and B. C. Voshell of the Socony-Vacuum Oil Company, Inc., was elected a Director representing the Supplier Company interests.

Arrangements are now being carried through the formative stages toward holding the next Convention in Buffalo, New York.

Directors Make Important Society Changes

The Directors of the Society held two meetings, one preceding the Annual Convention and one following it.

The most important item of business is, of course, associated with the election of new officers, and has already been announced; Oscar L. Maag was elected President; William F. Leonard, Secretary and Treasurer; Burgess H. Jennings, Vice-President at Large; Dudley D. Fuller, Eastern Regional Vice-President; Norman C. Penfold, Mid-Western Regional Vice-President, and Robert G. Larsen, Western Regional Vice-President.

The Directors also approved the plan of setting up a full time Secretary of the Society, and the opening of a formal office in Chicago. Mr. William F. Leonard is now the Society's Secretary and has been really making things "hum" in Society matters. A very fine office has been opened up in Room 1708—Fisher Building—343 S. Dearborn Street, Chicago 4, Illinois. The Society is looking forward to even greater progress with the greater attention which can now be devoted to its interests.

The Directors approved the budget for the coming year and authorized the Editor to put LUBRICATION ENGINEERING on a bi-monthly basis from its present quarterly status as soon as conditions warrant it.

President Kipp was congratulated for his splendid work as President of the Society, and we are looking forward to a successful year under the leadership of President Maag.

User Reactions Toward Additive Oils*

By W. F. AUG

Research Engineer, Mack Mfg. Co., Plainfield, N.J.

In this paper the author outlines the requirements of lubricants, commenting as he enumerates them on the effect of additives on these requirements.

Prevention of corrosion, sometimes caused by water, is important, and in the past some EP additives have been the source of decomposition products which have been uncontrollable in the presence of water. Wettability, even under extreme heat, minimization of surface destruction, inherent stability, freedom from foaming, freedom from generation of unpleasant or noxious gases, detergency, and chemical and physical compatibility with other lubricants are important in lubricants, and can in many instances be improved by the use of additives.

WHEREAS other papers deal with the technical aspects of this interesting subject, I have been merely exposed to it mostly from the consumer angle.

This paper had to be given a title and, accordingly, "User Reactions toward Additive Oils" was selected as allowing sufficient field for maneuver yet restrictive enough to assure brevity.

First, it may be in order to review the essential requirements for lubricants. The order in which they are given may seem somewhat unorthodox but is based on the fact that lubrication must be adequate from the first instant of operation regardless of the temperature obtaining at the time of starting. In fact, some of the most important functions of lubricants are their role as preventives when the equipment happens to be idle.

1. The lubricant must prevent the forms of corrosion which can become the nucleus of fatigue failure, to which the modern high performance designs are becoming increasingly susceptible. The corrosion can, of course, be caused by the presence of free water resulting from the leakage of solid water into the lubricated cavity. More frequently, the water results from the condensation of water vapor which enters through breather vents. In the case of engines, considerable water vapor is forced past the piston rings or leaks down the exhaust valve stem guides. Unfortunately, the action of some of the decomposition products of certain E. P. (extreme pressure) additives have, in the past, been uncontrollable in the presence of moisture.

2. The lubricant must be able to keep the rubbing surfaces wetted even though higher than normal surface temperatures are temporarily attained. It is axiomatic that a surface cannot be properly lubricated by liquid which will not wet it. You are probably all familiar with the example of a stove lid so hot that a drop of water will merely dance around on it yet remain there much longer than a similar-sized drop on a somewhat cooler plate. In the latter case, if the water wets the plate the water will evaporate quickly, absorbing heat from the surface at a very rapid rate. It is important that a lubricant not only prevent the development of heat by lowering the coefficient of friction but also be able to rapidly extract the heat developed at localized hot spots. Remember that water can be a very efficient lubricant when used in the right place.

3. The lubricant, if it is to be classed as an E. P. type must be able to prevent or minimize surface destruction even though tiny areas reach the incandescent or melting temperatures at which welding would naturally occur. It might be in order to point out that there is experimental evidence to indicate that welding can occur at substantially room temperature at moderate pressure when surfaces are chemically clean. An E. P. additive or its decomposition product prevents attainment of the necessary cleanliness by chemically combining with the metallic surface to form a highly refractory and adherent metal salt film. It is felt that the salt film must not dissolve or be washed from the surface since this would lead to rapid chemical removal of metal. As long as the film adheres well, it is considered desirable to have it soft enough to be non-abrasive and to shear readily, thereby keeping the solid friction force and consequently the development of heat at a low level. If the E. P. or other additives tend to chemically attack any of the metallic components, including bushings, sleeve bearings, etc., at low temperature levels, the action must be self limiting. That is, the formation of the film must stop further chemical attack. The lubricant or the additive decomposition products must not have a chemical or solvent action relative to conventionally used gaskets, sealer paint, plastic plugs, leather or synthetic seals, etc.

4. The lubricant must have either a naturally inherent stability which minimizes sludge and gum formation or be fortified by another type of additive which tends to inhibit lubricant oxidation or polymerization. No doubt there are a number of you here who recall your amazement when some of the early E. P. oils changed in a comparatively few weeks of service from a lovely-looking gear oil to an evil-smelling black mess that made disassembly of a rear end differential (carrier) practically impossible, in spite of the use of drastic solvents, a steam jet, blow torch, or the energetic use of even a hammer and chisel.

*Presented at the May 3, 1946 meeting of the New York Section at the A.S.L.E.

5. The lubricant must not foam excessively. Excessive foaming can be defined as that causing the lowering of the liquid lubricant level to such a point that the lubrication function is impaired. No doubt most of you are familiar with the serious difficulties resulting from excessive foaming of aircraft engine oils. Some of the trouble could be traced to faulty installation designs and even poorly engineered engine components. The real improvement came with the use of still another additive, a foam suppressant. Foaming can lead to a messy and sometimes dangerous leakage through vents or breathers or into space from which it cannot return to the sump. Unfortunately, some of the additive type oils although satisfactory when "dry" would foam badly in the presence of even small quantities of moisture.

6. The lubricant must not generate vapors which are toxic or offensive. I can well remember some of the early laboratory testing of experimental gear oils which utilized telurium sulfide and later mercaptans. The pungency and lasting quality of the odor would make any self-respecting skunk green with envy. Even some of the recent oils can hardly be successfully substituted for milady's toilet water or the fragrance of new-mown hay. In all seriousness, a driver can wreck a truck with surprising speed and effectiveness if he resents being exposed all day to an odor which his nose or stomach cannot tolerate. It is, of course, also important that the prolonged exposure of the skin to contact with the new lubricants should not cause adverse physiological reactions.

7. One of the important functions of a lubricant, particularly engine oils, is associated with its cleansing ability. Not only should it have the ability to remove the gum, carbon, or soot deposits wherever they tend to form but it should hold these materials in suspension by a dispersing or peptising action which assures complete removal via the drain whenever the lubricant is periodically changed. It is probably in order to digress a bit here to point out that many an operator has been disappointed when he found that the fancy heavy-duty oil did not establish the same relative improvement of internal cleanliness he saw in the results from evaluation test methods. This is very likely due to the lack of similarity of his operation with those of the test conditions. It may come as a shock to some to learn that paying the added price for detergent dispersant oil will not eliminate the need for adequate temperature control, crankcase ventilation, etc. Only during the comparatively recent months is the real importance of the fuel on overall engine deposits being properly appreciated. The improvement effected by better oil can be easily overshadowed by change to another fuel which in itself might, according to specification, be considered of adequate quality.

8. The lubricant should preferably be chemically compatible with other commercially available lubricants. It is, of course, also important that make-up oil when added to the same oil in use should not upset a critical solubility of dissolved gums, etc.

Other than to merely mention them, I hardly need review for this gathering the other obviously desirable characteristics of lubricants or their significance. They can usually be attained to a satisfactory degree without recourse to additives. Briefly they are:

1. Adequate viscosity at maximum operating temperature
2. Reliable viscosity index
3. Satisfactory channel test or low temperature pumpability
4. Desirable specific heat value
5. Suitable vapor pressure range

The troubles that plague the user of newly devised products have not been lacking with respect to "improved and fortified lubricants." This seems to be the inevitable price for progress. I suspect that the pattern of improvement in lubricants will be similar to that for gasolines. The use of lead tetraethyl markedly changed the picture of engine design with respect to fuel utilization. Its widespread use brought with it a crop of headaches which bother us even today. The seriousness of the original problems has been ameliorated by the combined efforts of the engine builder, the refiner and, of course, the Ethyl Corporation.

The use of uncompounded oils will, no doubt, be continued where the added cost of their more expensive counterparts cannot be justified by design requirements. Due to the numberless variations in service conditions, limited selection from suitably rated units, or even downright conservative engineering there will be frequent cases where a properly refined straight mineral oil will not only prove adequate but actually give cheaper, more trouble-free service. The proper selection of the lubricant must continue to be based on the advice of a qualified manufacturer's representative, a trustworthy lubrication engineer, or, frequently, the good plain horse sense and experience of the operator. Continued improvement and standardization of the additive oils will surely lead to the widespread adoption of designs that fully realize the advantages to be gained by compounding.

In closing, may I point out that your newly-formed society can be of great service in helping to bring about the necessary adjustments between designs and lubricants that will assure maximum effectiveness and efficiency in the utilization of improved mechanism design.

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OILS AND LUBRICANTS PATENT ABSTRACTS

Compounded Hydrocarbon Oil — Patent #22,829 — John T. Rutherford and Robert J. Miller, assignors, by mesne assignments, to California Research Corp.

A hydrocarbon oil composition comprising a major proportion of hydrocarbon oil of lubricating viscosity and a small amount, sufficiently substantially to stabilize the oil against deterioration by heat and oxidation, of a polyvalent metal salt of sulfur-containing acid of phosphorus, said acid of phosphorus containing at least one oil-solubilizing organic substituent, the number of carbon atoms contained in said acid of phosphours being at least 24.

Compounded Oil—Patent #22,830—John T. Rutherfodd and Robert J. Miller, assignors, by mesne assignments, to California Research Corp.

A hydrocarbon oil composition comprising a major proportion of hydrocarbon oil of lubricating viscosity and a small amount, sufficient substantially to stabilize the oil against deterioration by heat and oxidation, of an alkaline earth metal salt of a sulfur-containing acid of phosphorus, said acid of phosphorus containing at least one oil-solubilizing organic substituent, the number of carbon atoms contained in said acid of phosphorus being at least 24.

Lubricating Oil—Patent #2,414,257—Elliott Alfred Evans and John Scotchford Elliott, assignors to C. C. Wakefield and Co., Ltd.

An extreme pressure lubricant comprising a major proportion of a hyddocarbon mineral oil, an extreme pressure addition agent consisting of a di(3-carbomethoxy-4-hydroxyphenyl) polysulphide and an organic corrosion inhibitor selected from the group consisting of 2-mercaptobenzothiazole and benzothiazole disulphide present in amount less than 0.5 per cent and sufficient to eliminate corrosion of copper and cuprous alloys but insufficient materially to enhance the extreme pressure properties of the composition.

Method of Preparing Modifed Dehydrated Castor Oil Products—Patent #2,414,712—Don Shelon Bolley.

Method for forming liquid products containing modified, dehydrated castor oil which comprises mixing together dehydrated castor oil, a "maleic compound" and a non-conjugate liquid fatty oil, the amount of "maleic compound" calculated as maleic anhydride being between about 5.0% and about 25% based upon the weight of unsaturated constituents of the reaction mixture, and the amount of said non-conjugated liquid fatty oil being sufficient to maintain liquidity, and heating said mixture at temperatures between about 110 C and about 300 C until the "maleic compound" is chemically combined.

Lubricating System—Patent #2,414,887—Lawrence E. Miller, assignor to Hanes Hosiery Mills Co.

An automatic lubricating system for a knitting machine having a series of needles, cooperative movably-supported sinkers, and drive mechanism, said system comprising a reservoir for lubricating oil, means for conducting oil from the reservoir and releasing it at the sinkers, a normally closed valve associated with the reservoir, and means actuated from a movable part of the drive mechanism of the machine for momentarily opening the valve at predetermined intervals to control oil flow from the reservoir.

Application of Metal Sulfide Catalysts in the Vapor Phase Treatment of Mineral Oils—Patent 2,414,951—Zene V. Jasaitis and onald D. Davidson, assignors to Shell Development Co.

In the application of a metal sulfide catalyst for the vapor phase treatment of mineral oils in the presence of hydrogen, the improvement which comprises employing the catalyst with the following repeated sequence of processing steps: (1) dehydrogenation at a temperature above about 800 F of a relatively sulfur-free mineral oil containing less than 0.10% sulfur to obtain an appreciable increase in aromatic content of said oil; (2) removing carbonaceous deposits from the catalyst by burning; (3) desulfurization of a relatively sulfur-rich mineral oil containing at least 3%sulfur under hydrogenation conditions at a temperature below about 800 F.

The abstracts shown in this issue are from Official Gazette—Vol. 594, Nos. 2, 3, 4; Vol. 595, Nos. 1, 2, 3, 4; Vol. 596, Nos. 1, 2, 3, 4; Vol. 597, Nos. 1, 2.

Printed copies of patents are available from the Patent Office at 25 cents each. Address the Commissioner of Patents, Washington, D. C., for copies and for general information concerning patents.

Process of Removing Sulfur from Mineral Oil—Patent #2,414,963—Elliott B. McConnell, assignor to The Standard Oil Co.

A process of removing sulphur from mineral oil, which comprises heat-digesting the crude oil in the presence of a solid base forming sulphides with acid sulphur compounds, at a temperature at least 500 F but below substantial cracking, while preventing substantial vaporization, cooling the oil to around 200 F, mixing water therewith, separating off the water and sulphide matter formed, and subjecting the oil to fractional distillation into lighter and heavier fractions.

Lubricating Oil—Patent #2,415,296—Bert H. Lincoln and Gordon D. Byrkit.

A lubricant comprising in combination a major proportion of oil of lubricating viscosity and a minor proportion sufficient to stabilize said oil against oxidation, of a salt of a sulfurized relatively high molecular weight carboxylic acid, said carboxylic acid being unsaturated and being sulfurized by reaction with a phosphorus polysulfide containing more than fifty per cent of sulphur.

Refining of Glyceride Oils and Recovery of By-Products —Patent #2,415,301—Morris Mattikow, assignor, by mesne assignments, to Benjamin Clayton.

The process of refining glyceride oils and recovering unsaponifiables therefrom, which comprises subjecting a glyceride oil containing unsaponifiables to a neutralizing step employing a non-saponifying alkali and including the separation of soap stock from neutral oil in order to condition the glyceride oil for separation of unsaponifiables therefrom, thereafter mixing the separated neutral oil with an aqueous agent which will render unsaponifiables separable from said neutral oil, separating said aqueous agent along with unsaponifiables from the resulting oil and separating unsaponifiables from the separated aqueous agent.

Rust Preventing Turbine Oil—Patent #2,415,353—Robert K. Johnston and Jones I. Wasson, assignors to Standard Oil Development Co.

A mineral lubricating oil containing dissolved therein about 0.01% to about 1.0% of an alkali metal mahogany sulfonate and about 0.01% to about 1.0% of a polyvalent metal naphthenate, the ratio of the quantities of the two additives being adqjusted so that the oil blend exhibits substantially no emulsifying tendency in the presence of water.

High Boiling Aromatic Oil—Patent #2,415,541—Frank J. Soday, assignor to The United Gas Improvement Company.

As a new composition of matter, a hydrocarbon oil which has been physically separated from tar produced in the vapor phase pyrolysis at average temperatures above 1300 F of petroleum oil and which hydrocarbon oil boils between 225 C and 450 C but is free from and of greater volatility than the pitch of said tar, said hydrocarbon oil having an aromatic hydrocarbon content of at least 90%, being substantially free from solid bodies at 10 C and also being substantially free from resin-forming material.

Catalytic Treatment of Hydrocarbon Oils — Patent #2,415,716—Preston L. Veltman, assignor, by mesne assignments, to The Texas Co.

In catalytic conversion reactions selected from the group consisting of cracking and reforming hydrocarbon oil to produce high octane gasoline hydrocarbons, the method which comprises heating the oil to a temperature in the range around 700 to 1100 F and subjecting the thus heated oil to momentary contact with a solid catalyst substantially non-volatile at temperaures below about 1200 F and comprising a compound containing magnesium fluoride, silica and aluminum fluoride hemi-hydrate such that there is substantial conversion of the oil into gasoline hydrocarbons of high octane value with relatively small carbon formation.

Lubricant — Patent #2,415,833 — Louis A. Mikeska and Allen R. Kittleson, assignors to Standard Oil Development Co.

A hydrocarbon oil having incorporated therein a small proportion, sufficient to stabilize said oil, of an aromatic methylene thioether containing at least one substituent linked to an aromatic nucleus from the group consisting of hydroxyl and sulfhydryl radicals and metal salts thereof.

Composition of Matter Suitable for Use as a Lubricant and Lubricant Comprising the Same — Patent #2,415,836—John M. Musselman, assignor to The Standard Oil Company.

The process for making a composition suitable for use as a lubricant and as an addition agent to improve the characteristics of lubricating oils and greases, comprising reacting a phosphorous sulfide with an oxygen-containing wax at a temperature of at least 275 F to prevent thiophosphate formation and to remove the major portion of oxygen in the wax by reaction with the phosphorus in the sulfide, removing the phosphorus and oxygen-containing sludge from the reaction product, and reacting said product with a compound of a metal selected from the alkali and alkaline earth groups to form the corresponding metal compound of said reaction product.

Lubricant or the Like—Patent #2,415,837—John M. Musselman and Herman P. Lankelma, assignors to The Standard Oil Co.

A composition of matter suitable for use as a lubricant and as an addition agent to a lubricating oil, which comprises the product of the reaction of sulphur reacted at a temperature at which sulphur reacts with the reaction product of a phosphorus sulfide reacted at a temperature of and above thiopbosphate formation with an

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oxygen-containing compound selected from the group consisting of aliphatic, alicyclic and aromatic oxygen-containing compounds having a boiling point of at least 300 F and forming an oil-miscible reaction product.

Lubricating Composition Preparation—Patent #2,415,838—John M. Musselman and Herman P. Lankelma, assignors to The Standard Oil Co.

A composition of matter suitable for use as a lubricant and as an addition agent to a lubricating oil, which comprises the product of the reaction of sulfur reacted at a temperature at which sulfur reacts with an alkaline earth metal compound of the reaction product of a phosphorus sulfide reacted at a temperature of and above thiophosphate formation with an oxygen-containing compound selected from the group consisting of aliphatic, alicyclic and aromatic oxygen-containing compounds having a boiling point of at least 300 F and forming an oil-miscible reaction product.

Refining Fats and Oils—Patent #2,416,146—Howard C. Black and Walter F. Bollens, assignors to Industrial Patents Corp.

The process of refining glyceride oils containing gums, free fatty acids and coloring matter, which comprises, degumming said oils with an aqueous medium to effectively remove gums from said oil and treating said oil with a selective solvent for fatty acids, said process including the steps of separating from the oil a solvent phase containing free fatty acids and an aqueous phase containing gums to produce a resulting oil substantially free from gums and having reduced color and fatty acid content, and the step of further treating the resulting oil with a dilute alkali solution to further reduce the color and fatty acid content of the oil.

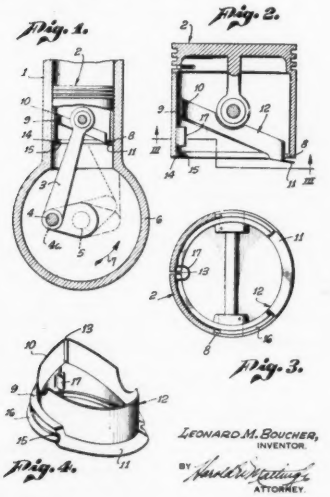
Petro'atum Sulfonate—Patent #2,416,192—Richard W. Mertes, assignor to Union Oil Co. of California.

An improved lubricant which comprises a major proportion of a lubricating oil and a minor proportion sufficient to improve the service characteristics of said lubricating oil of a sulfonate concentrate prepared by contacting a hydrocarbon stock containing at least about 10% of petrolatum with a sulfonation agent, neutralizing the product with an alkaline neutralizing agent, and separating the aqueous phase and the solid oil insoluble reaction products from the resulting sulfonate concentrate.

Mineral Oil Composition — Patent #2,416,281 — Henry G. Berger and Everett W. Fuller, assignors to Socony-Vacuum Oil Co., Inc.

An improved mineral oil composition comprising a viscous mineral oil fraction having in admixture therewith: a minor proportion, from about 0.5 per cent to about 10 per cent, of an oil-soluble metal sulfonate; and a minor proportion, from about 0.10 per cent to about 3.0 per cent, of an oil-soluble, phosphorus- and sulfur-containing reaction product obtained by reaction of a phosphorus sulfide and a material selected from the group consisting of a dicyclic terpene and an essential oil predominantly comprised of a dicyclic terpene at a temperature greater than about 100 C.

Apparatus for Lubricating Engine Pistons and Cylinders—Patent #2,416,429—Leonard M. Boucher.



In a device for lubricating pistons and cylinders of engines, a ring member forming an annular shelf having at one side of the annulus a lip projecting beyond the circle described by the annulus, and means for securing said shelf within a piston to dispose the shelf in a diagonal plane therein with the lip projecting immediately below the piston skirt into close relation to the adjacent cylinder wall.

Prevention of Foaming of Hydrocarbon Oils—Patent #2,416,360—Charles E. Trautman and Henry A. Ambrose, assignors to Gulf Research and Development Co.

A process of suppressing foaming in hydrocarbon oils and oil compositions containing them, comprising producing in the oil a stable fine dispersion of a liquid organo-germanium oxide condensation product substantially insoluble in the oil and having a low interfacial tension toward the oil, in an amount sufficient to decrease the normal foaming tendency of said oil and insufficient to deleteriously modify other desirable properties of the oil.

A hydrocarbon oil composition substantially resistant to foam formation, comprising a hydrocarbon oil and a liquid organo-germanium oxide condensation product substantially insoluble in said oil and having a low interfacial tension toward said oil, stably dispersed in said oil in fine particles in an amount sufficient to decrease the normal foam forming properties of said oil and insufficient to deleteriously modify the desirable properties of said oil.

Prevention of Foaming of Hydrocarbon Oils—Patent #2,416,503—Charles E. Trautman and Henry A. Ambrose, assignors to Gulf Research and Development Co.

A composition of matter of reduced foaming properties comprising an organic liquid having foaming tendencies and a small amount, less than 0.1 per cent, of an active defoaming compound comprising a dehydration silicon oxide condensation product.

Prevention of Foaming of Hydrocarbon Oils—Patent #2,416,504—Charles E. Trautman and Henry A. Ambrose, assignors to Gulf Research and Development Co.

A process of suppressing foaming in hydrocarbon oils and oil compositions containing them, comprising incorporating in said oil a suspension of a liquid organo-silicol condensation product having a low interfacial tension toward said oil in an amount sufficient to provide in the oil a greater amount of said condensation product than is soluble in said oil and producing a stable fine dispersion of said liquid organo-silicol condensation product in said hydrocarbon oil.

Catalytic Conversion of Oils—Patent #2,416,608—John M. Brackenbury, assignor to Shell Development Co.

In the production of useful products including gasoline and fuel oil from petroleum, the process comprising separating the petroleum by distillation into a naphtha fraction boiling between about 320 F and 450 F, a heavy reflux condensate and a reduced crude, subjecting the reduced crude to a flash distillation under reduced pressure and under mild cracking conditions to produce a heavy residue and between 50% and 75% of a heavy flash cracked condensate having 75% of a heavy flash cracked condensate having a molecular weight between about 280 and 300 with the formation of less than 1% gas and less than 1% gasoline, mixing said naphtha fraction with a finely divided catalyst and conveying the mixture to the bottom of a cracking zone containing fluidized cracking catalyst, introducing at

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an intermediate point in said cracking zone said heavy flash cracked condensate thereby to simultaneously crack said naphtha at a relatively low space velocity and said heavy flash cracked condensate at a relatively high space velocity separating the cracked product into a gasoline fraction and a heavy aromatic condensate, and combining said heavy aromatic condensate with said heavy residue to produce fuel oil.

Lubricant—Patent #2,416,807—Franklin M. Watkins, assignor to Sinclair Refining Co.

A lubricating oil composition consisting principally of a petroleum lubricating oil fraction and containing in solution in said oil from about 0.05 to about 1%, by weight, of the reaction product of stearonitrile and a phosphorus sulfide of the group consisting of P_2S_5, P_2S_3, and P_4S_7.

Compounded Mineral Oil—Patent #2,416,985—Bruce B. Farrington and John T. Rutherford, assignors, by mesne assignments, to California Research Corp.

A base metal salt of a phosphoric acid ester containing at least one alkylaryl group and a total of 5 to 16 saturated carbon atoms in the alkyl radicals of said alkylaryl groups.

Removal of Sulfur Compounds from Hydrocarbon Oils—Patent #2,417,041—George W. Ayers, Daniel M. Barton, and Erskine E. Harton, assignors to The Pure Oil Co.

The method of reducing the sulfur content of hydrocarbon oil containing organic sulfur compounds of the group consisting of mercaptans and disulfides comprising contacting the liquid oil at temperatures not substantially in excess of 100 C with the solid reagent resulting from the action at temperatures not substantially in excess of normal atmospheric temperature of an alkali solution on an alloy containing an element selected from the group consisting of aluminum, silicon, beryllium and zinc and a metal selected from the group consisting of nickel and copper.

Lubricant—Patent #2,417,087—Carl F. Prutton, assignor to The Lubri-Zol Corp.

An extreme pressure lubricant comprising a major proportion of mineral lubricating oil and an aromatic compound containing (a) an aromatic nucleus, (b) an aliphatic substituent containing more than three carbon atoms, and (c) an inorganic substituent containing an element of the class consisting of oxygen and sulphur, said compound present in an amount sufficient to increase the load carrying capacity of the composition so as to prevent seizure and scoring of the bearing lubricant thereby when operated under conditions of boundary lubrication.

Lubricating Composition—Patent #2,417,088—Carl .F Prutton, assignor, by mesne assignments, to The Lubri-Zol Corp.

A lubricating composition comprising the combination of an ester of a naphthenic acid and an organic sulphur compound.

Heating Oil—Patent #2,417,236—Artie Q. Cato, George Wash, and Albert J. Shmidl, assignors to Std. Oil Development Co.

A composition prepared for use as a distillate-type heating oil comprising chemically unrefined catalytically cracked naphtha distillate and chemically refined crude petroleum and thermally cracked naphtha distillates, said composition boiling within the range of about 350 F and 700 F and having a Tag-Robinson color no less than of the order of 15 after being subjected to storage under atmospheric temperature for approximately six weeks.

Lubricant—Patent #2,417,264—Arnold J. Morway and John C. Zimmer, assignors to Std. Oil Development Co.

An improved lubricating grease composition comprising a low pour point lubricating mineral oil distillate, 10-20% of a neutral to basic lithium soap of a soap stock selected from the group consisting of saturated fats and saturated fatty acids containing not more than 0.1% alkali calculated as NaOH and 1-2% of a soap selected from the group consisting of zinc soap and tin soap.

Instrument Lubricant—Patent #2,417,281—Jones I. Wasson and John C. Zimmer, assignors to Std. Oil Development Co.

A fluid lubricating composition consisting of 96.5% di-2-ethylhexyl sebacate, 0.5% 2,6 dittertiary butyl para cresol, and 3% calcium petroleum sulfonates.

Lubricant—Patent #2,417,283—John C. Zimmer and George M. McNulty, assignors to Std. Oil Development Co.

As a composition of matter, a mineral oil soluble sulfurized cutting oil base comprising a cosulfurized blend of tall oil and an ester of a monohydric alcohol of at least 10 carbon atoms and a high molecular weight fatty acid.

Lubricating Oil and Method of Lubricating—Patent #2,417,305—Edwin C. Knowles, Frederic C. McCoy, and John A. Patterson, assignors, by mesne assignments, to The Texas Co.

An improved lubricant adapted for use in internal combustion engines, which comprises a mineral lubricating oil having incorporated therein a small amount of a sulfurized monocyclic terpene hydrocarbon sufficient to impart corrosion inhibiting properties to the oil, and a small amount of an additive ingredient possessing detergent properties sufficient to inhibit the lacquer and varnish-forming tendencies of the oil.

Method of Refining Crude Wool Grease—Patent #2,417,329—Eugene Snyder, assignor to American Chemical Paint Co.

In the refining of crude wool grease the process which includes emulsifying the grease by agitating and heating it with water and soap to a temperature above its melting point, adding to the emulsion a relatively small amount of a water-soluble, substantially neutral, sulphonated fixed oil, allowing the mass to subside to form a water layer and a supernatant grease layer, and then separating the grease layer from the water layer.

Lubricating Composition—Patent #2,417,428—Lester W. McLennan, assignor to Union Oil Co. of California.

In the process of producing a lubricant the steps of reacting 1.0 equivalent of a saponifiable material with more than 1.1 equivalents of a basic metal compound in order to effect saponification of the saponifiable material, subsequently increasing the temperature and contacting the reacting mass with oxygen in order to cause a partial oxidation of the soap present, and finally adding mineral oil.

Complex Basic Soap Greases—Patent #2,417,429—Lester W. McLennan, assignor to Union Oil Co. of California.

A lubricating composition comprising mineral oil and a metal soap complex, said soap complex having atoms of at least two different metals, at least one of which is polyvalent, and containing a ratio of equivalents of metals to equivalents of saponified high molecular weight organic acids between about 1.1 and 4 and being substantially free from readily titratable excess alkalinity, in which the ratio of equivalents of the different metals is between 0.1 and 3.0.

Lubricants—Patent #2,417,430—Lester W. McLennan, assignor to Union Oil Co. of California.

A lubricating composition comprising mineral oil and strontium soap complex, the latter being a molecular complex containing a ratio of equivalents of strontium to equivalents of saponified high molecular weight organic acids between about 1.1 and 4, and being substantially free from readily titratable excess alkalinity.

Lubricants—Patent #2,417,432—Lester W. McLennan, assignor to Union Oil Co. of California.

A lubricating composition comprising mineral oil and calcium soap complex, in which the calcium soap complex is made by reacting in the presence of oxygen in excess of one equivalent of a basically reacting calcium compound with one equivalent of a saponifiable material to yield said calcium soap complex containing a ratio of equivalents of calcium to equivalents of saponified high molecular weight organic acids between about 1.1 and 4 and being substantially free from readily titratable excess alkalinity.

Lubricating Composition—Patent #2,417,433—Lester W. McLennan, assignor to Union Oil Co. of California.

A lubricating composition comprising mineral oil and a barium soap complex, the latter being an association complex comprising a normal barium soap and a barium salt in which the ratio of equivalents of barium salt to equivalents of normal barium soap is between about 0.1 and 3, said composition being substantially free from readily titratable excess alkalinity.

Lubricants—Patent #2,417,437—Lester W. McLennan, assignor to Union Oil Co. of California.

A lubricating composition comprising mineral oil and magnesium soap complex, the latter being a molecular complex containing a ratio of equivalents of magnesium to equivalents of saponified high molecular weight organic acids between about 1.1 and 4, and being substantially free from readily titratable excess alkalinity.

Manufacture of Grease—Patent #2,417,495—Harold G. Houlton, assignor to The Girdler Corp.

The continuous process for the manufacture of grease from oil and a stiffening agent, which comprises bringing together the oil and stiffening agent in substantially the relation proportions desired in the final product, continuously cowing the mixture of oil and stiffening agent as a relatively thin confined layer through a zone having a heat-transfer wall, and heating said thin layer of mixture in said zone through said wall to a temperature at least sufficient to effect solution of the stiffening agent in the oil, while simultaneously continuously and rapidly removing films from said heat-transfer wall and violently and continuously mixing the same with the remainder of said mixture in said thin layer whereby substantially continuously to bring relatively fresh material to said transfer wall; thereby to effect extremely rapid heating of said mixture in said layer to a uniform temperature and to effect a thorough and intimate dispersion of the stiffening agent and oil, producing a hot grease of uniform consistency.

Lubricant—Patent #2,417,562—John R. Morris, assignor to The Texas Co.

A lubricant comprising a hydrocarbon oil and 0.01-5.0% by weight of an oil-soluble metal salt of a sulfur-containing acid of phosphorus possessing at least one ester radical derived from an unsaturated alkyl phenol, said unsaturated alkyl phenol being derived from a member of the Anacardium genus of the Anacardiaceae family.

Process for Removing Impurities from Oils—Patent #2,417,637—Harold C. Eddy, assignor to Petrolite Corp,. Ltd.

A process for purifying mineral oils of low water content to remove water-soluble or water-wettable impurities capable of being taken up by a relatively fresh water, which process includes the steps of: mixing said oil and relatively fresh water to form an emulsion while using a mixing action more intense than that which will permit complete resolution of the emulsion into oil and water in the succeeding resolution step; partially resolving said emulsion to form an oil containing a small amount of dispersed water and a sludge relatively rich in water as compared to the water content of said emulsion and comprising a concentrated emulsion of water in oil; mixing proportioned amounts of said sludge and said relatively fresh water to form a new emulsion; establishing an electric field of sufficient intensity to coalesce the water droplets of said new emulsion; subjecting said new emulsion to the action of said field while there is present in said field sufficient oil to permit maintenance of high voltage gradients therein, said field acting to coalesce the dispersed water of said new emulsion; and separating the coalesced water.

Process for Breaking Petroleum Emulsions—Patent #2,417,738—Melvin De Groote, assignor to Petrolite Corp., Ltd.

.A process for breaking petroleum emulsions of the water-in-oil type, characterized by subjecting the emulsion to the action of an acidic partial ester derived by reaction between a polycarboxy acid and dimerized 9,11-linolodiricinolein.

Process for Breaking Petroleum Emulsions—Patent #2,417,739—Melvin De Groote, assignor to Petrolite Corp., Ltd.

A process for breaking petroleum emulsions of the water-in-oil type, characterized by subjecting the emulsion to the action of drastically oxidized dimer.

Process for Breaking Petroleum Emulsions—Patent #2,417,740—Melvin De Groote, assignor to Petrolite Corp., Ltd.

A process for breaking petroleum emulsions of the water-in-oil type, characterized by subjecting the emulsion to the action of a hydroxyacetylated and drastically oxidized dimer.

Lubricating Composition—Patent #2,417,826—William A. Jones, assignor to Continental Oil Co.

A lubricating composition comprising a mineral oil of lubricating viscosity normally tending to oxidize in use, having incorporated therein from about 1% to about 5% of the product of reaction at an elevated temperature of an unsaturated hydrocarbon and the material derived by fusing together a metal sulfide, a phosphorus sulfide, and elemental sulfur.

Lubricating Composition—Patent #2,417,827—William A. Jones, assignor to Continental Oil Co.

A lubricant comprising an oil of lubricating viscosity normally tending to oxidize in use having incorporated therein an inorganic tetra-thiophosphate in an amount sufficient to inhibit oxidation of the oil.

Lubricant—Patent #2,417,833—Bert H. Lincoln and Joseph M. Hersh, assignors to Continental Oil Co.

A lubricant comprising a major proportion of an oil of lubricating viscosity having a minor proportion, sufficient to improve the lubricating characteristics of the oil, of an aliphatic diacid of from 6 to 12 carbon atoms, said acid having terminal carboxyl groups which are substituted with a silicon containing radical.

Inhibited Oil—Patent #2,417,876—Arthur W. Lewis and John E. Schott, assignors to Tide Water Associated

A composition suitable for lubricating modern engines comprising a hydrocarbon lubricating oil in major proportion, a minor proportion of a thiophosphoric acid bearing corrosion inhibiting material and a sufficient amount of a sulfonic acid substance effective in the composition to inhibit the rusting of ferrous metal motor parts, said sulfonic acid substance and said bearing corrosion inhibiting material being present in a weight ratio of not less than about 4 to 1.

Rust Preventative Composition—Patent #2,418,075—Myron H. Kollen and Marcellus T. Flaxman, assignors to Union Oil Co. of California.

An anti-rust composition comprising between about 5% and 95% of oil-soluble polyvalent metal tall oil soap and between about 5% and 85% of oil-soluble polyvalent metal degras soap.

An anti-rust composition comprising 50% to 85% lead tall oil soap, 5% to 30% lead wool grease soap, 5% to 10% paraffin wax, 5% to 10% lubricating oil and 0.01% to 0.1% of cobalt in the form of an oil-insoluble salt.

Lubricating Oil—Patent #2,418,358—Bert H. Lincoln and Gordon D. Byrkit, assignors to Continental Oil Co.

A lubricant comprising in combination a major proportion of hydrocarbon oil and a minor proportion, sufficient to stabilize the oil against formation of corrosive oxidation products or sludge forming compounds, of a boron compound selected from the class consisting of compounds having the general formulas R_2BOR' and $RB(OR')_2$ in which R and R' are organic radicals, at least one of which contains a carboxylic ester group.

Lubricant—Patent #2,418,422—Robert C. Palmer, assignor to Sinclair Refining Co.

A mineral oil composition comprising a major proportion of mineral oil with which there have been blended about 14 to 28% of calcium petroleum sulfonate and about 0.7 to 3% of a mixture of mono- and di (diamylphenyl) phosphates.

Improvement in Winter Vegetable Oils—Patent #2,418,668—Harvey D. Royce, assignor to The Southern Cotton Oil Co.

A winter vegetable oil, characterized by substantial stability against resistance to clouding and stearin separation, having colloidally dispersed therein a small percentage of aluminum tristearate adequate to enable the oil to withstand a cold test of at least 24 hours.

Process of Acid Refining Viscous Hydrocarbon Oil—Patent #2,418,784—Darwin M. McCormick, Carrol B. Barbour, and William K. Griesinger, assignors to The Atlantic Refining Co.

The process of acid refining viscous hydrocarbon oil with the production of acid sludge characterized by its ready pumpability, which comprises contacting said oil with sulfuric acid in the presence of an added small amount of a surface tension reducing agent sufficient to render the sludge readily pumpable, settling the resultant acid sludge, and separating the settled sludge from the oil.

News Books Bulletins and Manuals

Rarer Metals—by Jack DeMent and H. C. Dake—Chemical Publishing Co., Inc., New York, 1946. 392 pages. Price $7.50.

This book helps to satisfy a need created by the increasing interest in "rarer" metals. Basic data for over twenty metallic elements are correlated conveniently for the investigator. Typical metals are beryllium, thallium, titanium, columbium, tungsten, uranium, selenium and platinum. Metals of the rare earths are not included. The information on each element is presented under history, mineralogy, physical and chemical properties, compounds, extraction from ores, technology and analysis. Extensive bibliographies supplement each chapter.

Lubricant Pumps—automatic, motor-driven, manually operated and mechanically driven are described in detail in Bulletin 469 just issued by the Trabon Engineering Co., 1814 E. 40th St., Cleveland 3, Ohio.

Book Catalog for 1947 has just been issued by the Chemical Publishing Co., 26 Court Street, Brooklyn 2, N. Y., containing date of publication, number of pages, price and full table of contents of latest scientific books as well as textbooks.

Turbine Maintenance is covered by booklet B-3747 published by Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa. Geared turbine propulsion for marine applications is covered in Booklet B-3497, Diesel-electric marine drives in B-3495, and turbine-electric propulsion equipment in booklet B-3308-A

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Nice "Series 3000" bearings incorporate one-piece inner and outer races turned from high quality steel and carefully heat treated to a uniform and exact degree of hardness. A ball retainer (or separator), of the two-piece type, reduces ball contact friction and increases the range of allowable speeds, and although these bearings are designed primarily for radial loads, the depth of groove in the ball tracks provides considerable thrust capacity.

All bearings of this new series are finish ground on the O. D. to a tolerance of .006" or less and are held to a tolerance of .005" or less on the I. D. They are available double shielded, with one shield or without shields and can be furnished grease packed or without grease, as desired.

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Lubricant for High Temperature and Pressure Metal Working

Die Slick No. 5 is a special metalworking lubricant developed for extremely high temperatures and/or pressures by G. W. Smith & Sons, 5400 Kemp Road, Dayton 3, Ohio. According to the manufacturer it has been found effective in preventing scoring and sticking of ferrous or non-ferrous metals in applications such as hot drawing or piercing, forging, and deep drawing.

It can be applied with a brush, swab or spray, and, the manufacturer states that it will withstand pressures of more than 100,000 psi, and can be used at temperatures up to 2300 F. The compound is said to be non-corrosive and non-carbon forming, to cause no objectionable gases or smoke, and not discolor the work.

Non-Petroleum, Synthetic Cutting and Grinding Oil

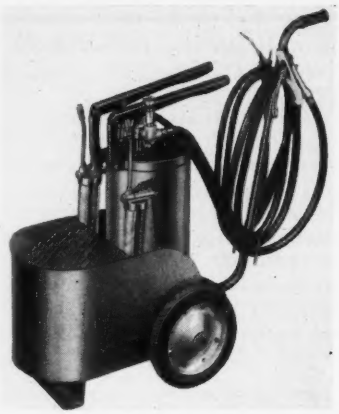
Silver-Chip No. 60 Cutting and Grinding Oil, a war-time development, is now being produced in volume by Machinery Lubricants, Inc., 31 St. James Avenue, Boston 16, Mass. and distributed nationally.

It is claimed that the new product mixes easily with water of any degree of hardness and offers a true solution instead of an emulsion. Water mixtures of 1 to 25, 1 to 50, and 1 to 100 provide higher lubricity, it is alleged, as well as genuine transparency, when compared with commercial qualities of water-soluble cutting and grinding oils.

Of particular interest to metalworking concerns is the ability of the new development to exceed conventional water coolants in range of utility and to provide a water coolant satisfactory for numerous types of tough metal-cutting jobs ordinarily requiring more expensive straight-oil type coolants.

The manufacturer offers a free working sample to any metal-working concern of established credit. Distribution is through industrial-supply houses exclusively.

New Lube Service Cart



A new industrial lubricating unit for plant-wide use has been announced by the Industrial Division of Gray Company, Inc., of Minneapolis 13, Minnesota.

The Graco Lube Service Cart is a complete lubrication department on wheels, needing no air or electric connections. It carries a generous supply of three different lubricants (two greases and one oil), thus eliminating frequent trips to the oil storage room.

This specially designed, one-man operated, portable unit is said to make systematic, multi-bearing lubrication practical and profitable, and to speed up production schedules by reducing lubrication time.

Two 1-lb. lever guns and one ½ pt. Pistol Oiler are included. The pressure lube pump has a built-in gun loader for hand guns. Lube and oil compartments are easily filled without removing pumps. The front section of the cart incorporates a large tool box, with hinged lid, which also serves as a platform step for the operator to reach high bearings.

Plans are already under way for the Third Annual Meeting of the A.S.L.E. to be held in Buffalo next March.

The Program Committee will welcome suggestions as to the type of program most desired by the membership body. The Committee is especially eager to obtain papers dealing with original work in the field of lubrication.

Please address suggestions to the Chairman, Dr. Henry E. Mahncke, Westinghouse Research Labs., East Pittsburgh, Pa.

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Greer Hydraulics, Inc., 454 18th St., Brooklyn 15, N. Y., describes their full line of micronic filters in a new pamphlet. The importance of oil cleanliness and the hazards of contaminated oil are outlined, as are complete details of construction and materials used. Full engineering data, performance charts and parts lists are included.

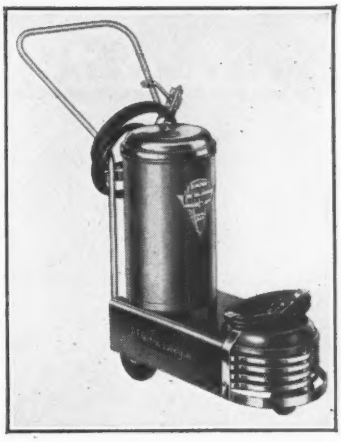
Hilliard Corporation of Elmira, N. Y., have issued a new catalog, consisting of complete bulletins on their line of lubricating, fuel and industrial oil purifying equipment.

Full specifications, line drawings, cut-away views, many of them in color, contribute to the usefulness and clarity of the catalog.

"DC Antifoam A" is a new technical pamphlet recently issued by the Dow Corning Corp., Midland, Mich. It describes the physical properties of the product and outlines various methods for using it as an antifoam agent.

Electric Lubrigun

Model 244 Lincoln Electric-Motor Operated *Lubrigun* is the newest addition to the company's complete line of Lubricating Equipment. This High Pressure Grease Gun is a streamlined, portable unit equipped with a positive displacement pump, powered by a standard make ¼ h.p. universal motor for 110/115 volts A.C. or D.C.; provides rapid, positive delivery of all types of lubricants which readily seek their own level. Unit is mounted on two large rubber tire casters and one ball-bearing swivel caster for maximum portability. Full lubricant pressure is instantly available. Capacity of lubricant container is 30 Lbs. A 7-ft. high-pressure Hose Assembly with Control Valve, and a 12-ft. electric



plug-in cord are standard equipment on this Model. The manufacturer, Lincoln Engineering Company, 5701 Natural Bridge Avenue, St. Louis 20, Missouri will gladly send complete information upon request.

Edward F. Dykstra, formerly of Standard Safety Equipment Co., has been appointed Advertising and Sales Promotion Manager of D. A. Stuart Oil Co., 2729-53 S. Troy St., Chicago 23, Ill.

This same firm has recently published a new four-page folder describing *KleenKut,* a laboratory controlled water-mix cutting oil. The folder describes typical applications and proper method of mixing.

Promotion of a group of top executives and realignment of their duties has been announced by Winslow Engineering Company of Oakland, California, manufacturers of fuel oil filters, lubricating oil conditioners and elements for automotive and industrial engines. According to Charles A. Winslow, President, the changes in assignment of personnel are the first step in a program of expanded sales and production activity.

Five men are affected by the changes. Their new positions are: L. L. Moore, vice-president and general manager; W. G. Nostrand, executive engineer; E. L. Helble, sales manager; J. J. Meyer, Jr., chief engineer; and J. D. Sanderson, factory superintendent.

Four of these men have backgrounds of many years of experience with the Winslow organization, but Sanderson is a relative newcomer. He joined the firm in August of last year, following four and a half years as an officer in the Naval Reserve.

Charles F. Bonnet has been appointed assistant to Arthur J. Campbell, General Sales Manager, Industrial Chemicals Division, American Cyanamide Company. Mr. Bonnet will continue as Manager of the Petroleum Chemicals Department, and H. E. Nehms will be Acting Department Head.

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A.S.L.E. SECTION ACTIVITIES

Buffalo Section

The Buffalo Section of the A.S. L. E. held a meeting at the Hotel Markeen in Buffalo, New York, on November 22, 1946. In spite of inclement weather attendance was good. Membership and Program Committees were selected, headed by Chairman Dr. Parché for Program and Arthur Mould for Membership.

The equipment used for penetration and dropping point tests in grease labs was demonstrated by George Miller of Battenfeld Oil Co. and the Falex Testing Machine by Carl Lindemann of American Lubricants. A very instructive film on cutting oils was supplied by National Manufacturers of Screw Machine Association of Cleveland.

Discussion was so spirited and lively that it was unanimously decided that every program should, in the future, include similar demonstration. There was a very earnest discussion on the points raised by Mr. Hodson at the Niagara Falls, Ontario, meeting in October.

The regular meeting was held on January 21, 1947, at the Knights of Columbus Hall in Buffalo. This day and evening Buffalo experienced the worst blizzard of the winter; roads were blocked in all directions, but in spite of this, eleven (11) members fought their way through from Toronto and eight (8) came through from Rochester in a jeep, which was the only kind of passenger vehicle that could negotiate this road.

These adventurers and local members were well rewarded by the excellent demonstration and discussion of the S.O.D. Pressure Viscosimeter loaned by the Precision Scientific Company. The demonstration was handled by Elliott Chapman, Colonial Beacon, who worked on the early experimental stages of the machine, and Fred Koethen, Quaker State, who has done much field work as a member of the N.L.G.I. Technical Committee.

The discussion could have continued all night, so great was the interest in this subject, and we recommend it to other Sections as a stimulating program.

A meeting was held on April 10, 1947, at the Sheraton Hotel, Rochester, New York, under the auspices of the Rochester Engineering Society. Dinner was served to 64 people and the meeting was attended by 72, including 12 from Toronto, Canada.

A very instructive, illustrated presentation of the correlation of laboratory testing with field experience was given by Dave Hall and W. T. Everitt of the Eastman Kodak staff. Mr. Hall presented a series of slides showing how the tests are made and conditions established and controlled.

Mr. Everitt then supported this series with a set of slides made in the field showing failed bearings, gears, contaminated housings and corroded parts directly connected

(*Continued on page* 76)

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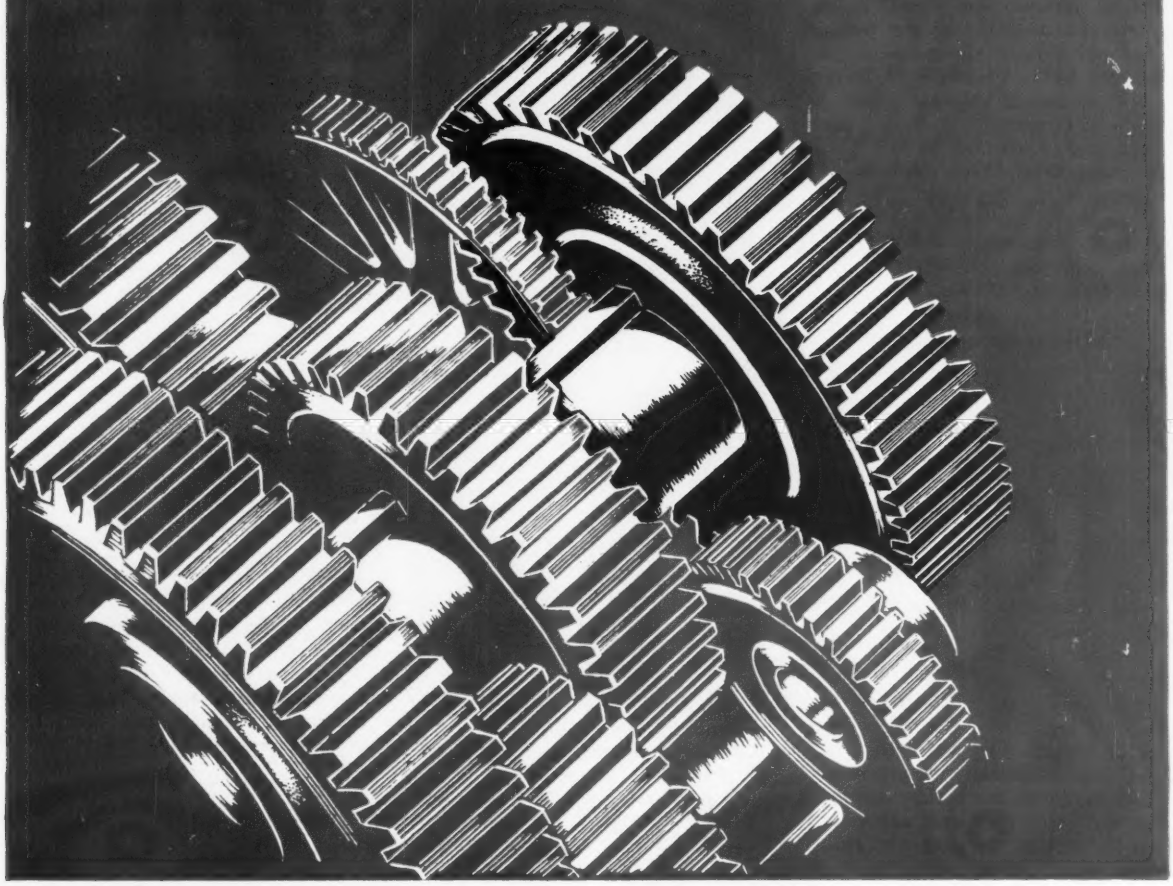

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Sections

(*Continued from page 74*)

with the products as they had been judged in the laboratory.

After the talk, a very spirited discussion took place in which more than half those present took part. Special interest was shown in the interfacial tension tests for turbine oils; and valuable points were contributed by E. Chalmers of Socony Vacuum and E. Markle of U. S. Shell, J. Courtright of Shell (Canada) and a number of the plant representatives. The meeting was adjourned at 11 o'clock. The next meetings will be on May 13, 1947, at Hotel Westbrook, Buffalo, New York, and June 13, 1947, at Toronto, Canada.

Milwaukee Section

The Milwaukee Section advanced its March 17th meeting to March 24th to avoid conflict with the National Convention. At this meeting, which was well attended, Mr. Walter Alexandroff, Technical Supervisor of the Pate Oil Company, spoke on "Water Emulsions."

The April 21st meeting covered the subject "Cutting Oils."

The Educational Program, under the guidance of Mr. Al Boie, progressed nicely. The meetings were held every Monday evening at the Milwaukee Engineering Society Building and covered a large number of topics. The attendance has been very gratifying with practically all of the original enrollees continuing. Mr. Oscar Frohman announces that a similar program is being planned for next year.

This section will close its season with a dinner at the Medford Hotel, at which time the new officers will be formally installed.

Pittsburgh Section

The regular February meeting of the Pittsburgh Chapter of the American Society of Lubrication Engineers was held at the Penn McKee Hotel, McKeesport, Pa., approximately 35 being present.

In the absence of Chairman Lykins, Vice-Chairman C. B. Kimpel presided.

After discussing plans for the National Convention, the meeting was turned over to W. H. Mandy, who presented the sound film, "Making and Shaping of Steel." The film was most entertaining as it showed and explained all phases of the steel industry from the coal mines and iron ore mines through manufacturing to consumer.

Northern California Section

Seated: L. W. McLennan, Charles Winslow, Wilbur Deutsch, H. G. Isbell. Standing: D. Moreton, R. G. Larsen, A. S. Horwitz, Merle Randall, Frank Kavanagh.

On February 6, 1947, Dr. R. G. Larsen, in his capacity as Western Regional Vice President of the American Society of Lubrication Engineers, called a meeting of a number of persons interested in the formation of a Bay area Section of the A.S.L.E. The meeting was preceded by dinner at 7:00 P. M. at the Embassy Club in Emeryville, California.

Each individual was asked to introduce himself to the meeting and indicate his business affiliation and position.

Dr. Larsen gave a detailed account of the history of A.S.L.E. and its objectives, and what it was hoped the proposed organized group might accomplish. He appointed Mr. Chas. Winslow as an interim chairman until permanent officers could be installed. Also appointed was: Mr. Deutsch as interim secretary-treasurer; an interim Nominating Committee, and an interim Arrangements Committee.

After considerable discussion, it was agreed that meetings should be monthly and that the first Tuesday in each month would probably be the most suitable date. It was suggested that the next meeting might be held at Angelo's (in Emeryville), where quarters were more commodious; this was to be left in the hands of the Arrangements Committee. At that meeting the election of officers could be held and other organizational procedure completed.

Dr. Larsen asked Mr. Frank Kavanaugh (California Research) if he would be willing to read a paper at the next meeting (March 6) and Mr. Kavanaugh agreed to do so.

During the evening a list was signed by all those present, numbering 24. A temporary membership committee was appointed to draw up a mailing list for issuing notices for the next meeting. It was hoped that the names on the list would include employees of industrial firms previously responsible for lubrication. It was the sentiment of the meeting that the society was specifically designed to meet the needs of such a group since other societies (e. g. SAE, ACS, A.I., ChE., etc.) already existed for other technical men. The success of our group doubtless depended upon the inclusion of this class of technical men.

Before the meeting adjourned, Dr. Larsen installed Mr. Winslow as chairman of the group so that the proper organization of the new group could be prosecuted and formal organization completed at the next meeting.

The officers nominated and sustained by the local group are as follows: Chairman, Wilbur Deutsch, Brooks Equipment Co.; Vice-Chairman, H. G. Isbell, Industrial Laboratory, Mare Island Naval Shipyard; Secretary-Treasurer, L. W. McLennan, Union Oil Company; Program Committee, Frank Kavanaugh, California Research Corp.; Merle Randall, Randall & Sons; Albert S. Horwitz, E. F. Houghton & Co.; Membership Committee, John P. Bourne, Standard Oil of California; Walter Smith, Tidewater Associated Oil Co.; Elvin B. Lien, Union Oil Co.; Arrangements Committee, E. S. Starkman, Shell Development Co.

Philadelphia Section

The Philadelphia Section held a dinner meeting Tuesday evening, March 4th, at the Engineer's Club. This meeting was well attended and addressed by two outstanding speakers.

Professor James I. Clower of the University of Delaware spoke on the "Fundamentals of Lubrication" and Mr. Gus Kaufman of the Texas Company spoke on "Additives in Greases." The audience, which filled the Gold Room to capacity, participated in an interesting discussion following both papers.

The meeting was preceded by an enjoyable social hour and dinner.

The Philadelphia Section ended their Fall and Winter technical sessions with a meeting held Thursday, May 8, at the Engineering Club. R. Q. Sharpe, of Socony Vacuum Oil Company of New York, gave the lecture. His topic was, "Machine Tool Lubrication and Hydraulic Fluids."

(*Continued on page 80*)

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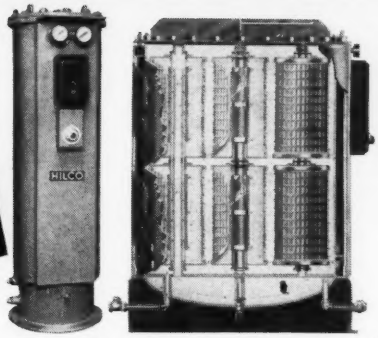

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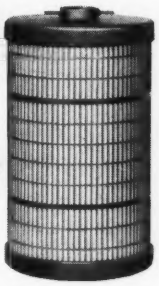

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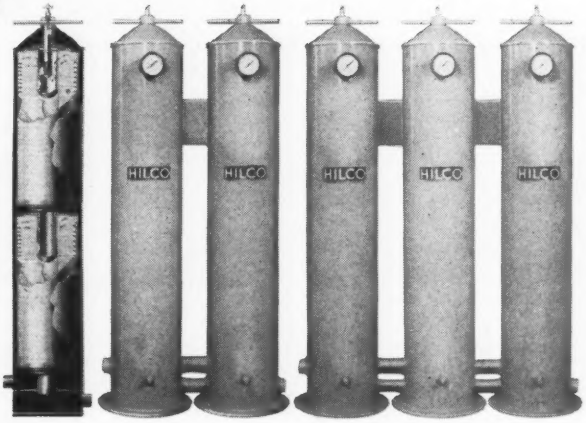

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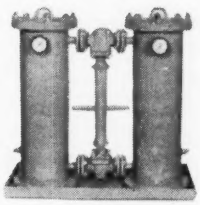

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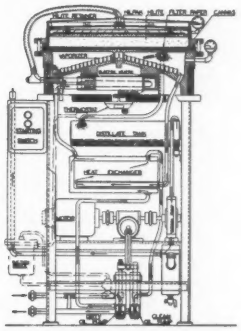

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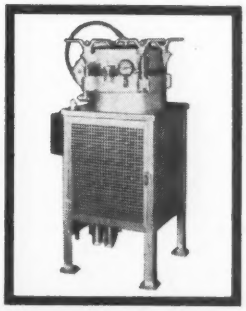

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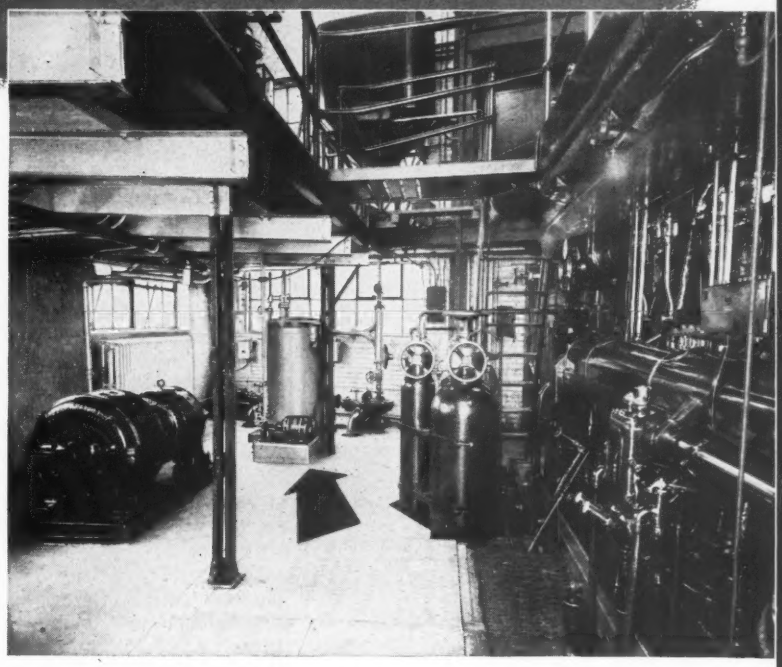
WHITE, TED
Ralph P. Keelor Co.
WILLIAMS, DUNCAN B.
Carbide & Carbon Chemicals Corp.
WILLIAMS, GEO. T.
Mine & Smelter Supply Co.
WILLIAMS, WESLEY B.
Wayne Chem. Prod.
WING, PAUL R.
Shell Oil Co., Inc.
WINN, CHARLES M.
Carnegie Illinois Steel
WIRTH, CHARLES, III
E. I. duPont de Nemours & Co.
WITT, C. O.
Shell Oil Co.
WOOD, H. STUART
American Cyanamid Co.
WORTHINGTON, HOWARD L.
Remington Arms Co.
WRIGHT, W. ANDREW
Sun Oil Co.
ZURAWSKY, FRANK, JR.
Grafo Colloids Corp.

When they pass their plates for "seconds"

that's proof!

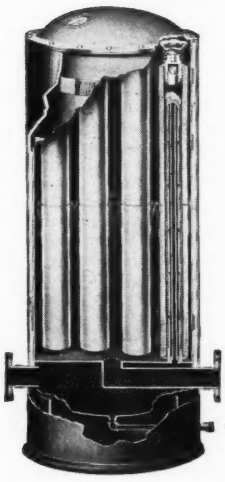


The Marshall (Mich.) City Electric and Water Works Installed a Honan-Crane Lube Oil Purifier in 1938

—a second in 1941

—a third in 1944

—and a fourth has been ordered for installation when a new engine is delivered



● The first Purifier, a model No. 2030, is serving a 1250 HP Nordberg Diesel. The second, a model No. 2036, is serving a 1500 HP Nordberg Diesel. The third, a model No. 2436, is serving *two* 550 HP Nordberg Diesels. And the fourth, another model No. 2436, will serve a 2400 HP Nordberg Diesel. The three in present service are handling approximately 1166 gallons of medium weight lube oil—with an average refill life of three months. C. W. Jennings, power plant chief engineer, sums it up simply: "Honan-Crane Lube Oil Purifiers are good insurance against bearing failure—and they increase the use-life of our oil by eliminating the need for frequent oil changes." . . . Note the space-saving, compact installation in the illustration.

There can be no stronger proof that Honan-Crane Oil Purifiers perform an extremely valuable service—a service that has increased productive efficiency or reduced operating cost (made money or saved money)—or *both.*

HONAN-CRANE CORP.

818 Wabash Avenue • Lebanon, Indiana

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☐ Please send me complete information on the advantages of lube oil purification and Honan-Crane Oil Purifiers.

☐ Please have a sales-engineer call.

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Company.....

Street..... Zone.....

City..... State.....

Honan-Crane Oil Purifiers *will* do *both.* They maintain your lubricating oil in its original clean condition—indefinitely in some instances. They remove the oil contaminants as rapidly as they appear. Clean oil carries no abrasives, acids, metallic soaps or compounds that increase wear on precision parts and surfaces, cause precipitation of gums and "varnishes," or build up sludge deposits. Thus they promote the most thorough lubrication and eliminate the causes of excessive wear. This is reflected in maximum operating efficiency for maximum duration. An added bonus is the greatly extended safe-use-life of your oil.

For complete information on oil purification and Honan-Crane Oil Purifiers, fill out and mail the coupon.

Chicago Section

The Chicago Section has been running an educational lecture program which has been very well received by members of the Section and by industry in the Chicago area. This has been meeting almost weekly, the first meeting being held April 1st and the last scheduled for May 23rd.

The program of lectures will probably be of interest to our various readers, and so is given complete.

TUESDAY, APRIL 1
Introduction, J. J. Slomer, Goodman Mfg. Co.
Story of Lubrication, E. P. O'Sullivan, The Texas Co.
"Lubrication," Film, Sinclair Oil Co.
Physical Properties of Lubricants, Geo. R. Dunne, The Pure Oil Company.

WEDNESDAY, APRIL 9
Bearings, Berry Bearing Co., Literature
Edwin M. Higgins of Master Lubricants Co.
Plain Bearings, J. W. Stack, Standard Oil Co. of Indiana.
Bearing Materials, Oscar Frohman, Ampco Metals Co.

MONDAY, APRIL 14
Gears—Worm, Open and Closed
W. P. Schmitter, Falk Corporation

FRIDAY, APRIL 25
Cylinders—Ways and Sliding Friction
John E. Rosnell, The Texas Company

TUESDAY, APRIL 29
Hydraulic Systems
C. R. Schmitt, E. F. Houghton and Co.
C. Langworthy, Vickers, Inc.

THURSDAY, MAY 8.
Application Hand, Bath, and Simple Devices
Socony-Vacuum Co., Engineering Dept.

MONDAY, MAY 12
Application
Centralized Systems and Servicing
Alemite, Div. of Stewart Warner Corp.
W. G. Youngclas, Junior

FRIDAY, MAY 23
Storage and Care of Lubricants
J. J. Slomer, Goodman Mfg. Co.

The next meeting of the Chicago Section will be the Golf Tournament and Doug Evans has announced that plans for this are now complete, with the Tournament to be held at the Cog Hill Country Club, June 10th.

Detroit Section

The first dinner meeting of the Detroit Section was held at the Rackham Building on January 24. There were about 70 in attendance.

Mr. George L. Sumner, of Westinghouse Electric Corporation, was principle speaker and his subject was "The Evaluation of Greases."

The next dinner meeting was held on Tuesday, February 25th, at the Rackham Building. The speaker was Mr. C. A. Underwood of General Motors Research.

Cleveland-Youngstown Section

The Cleveland-Youngstown Section held its April 22nd dinner meeting at the Youngstown Club in Youngstown, Ohio. Mr. T. P. Sands of the Monsanto Chemical Company, St. Louis, Missouri, presented a very interesting paper entitled "Custom Building Lubricants with Additives."

The May 27th meeting will be held at the Cleveland Engineering Society and arrangements have been tentatively made for Lt. H. V. Nutt, U. S. Naval Experiment Station, to speak on the subject of "Filters."

Plans are being made to elect the new slate of officers May 31st. Following this, the remaining meeting of the present year is the annual golf party which is being scheduled for early June.

Activities in the Fall will open with a Clambake in September, with the first papers meeting taking place in October.

The application of A.S.L.E. to join the Cleveland Technical Societies Council was unanimously approved on April 2, 1947, by the Board of Governors. This membership on the Council should be of real benefit to the Society and its members.

New York Section

Meetings of this Section since the start of the season have been characterized by high attendance and excellent papers and discussions.

At the November meeting, Frank Linn of G. E., Schenectady spoke on "Design of Turbine Bearings and Their Lubrication." At this same meeting Prof. F. Hodgkinson spoke on his experiences with lubricants and bearings over the past fifty years, and E. M. May of the Bowser Co. discussed the development and application of cellulose type filters to turbines.

Mr. Gus Kaufman's paper on "Additives in Greases," which is published in this issue, was the principal presentation at the January 30 meeting.

The general theme of the March Meeting was "Cutting Oils and Coolants". Mr. J. M. Loiacono of the Eclipse-Pioneer Division of Bendix presented an illustrated paper entitled, "A Metallurgist Looks at Cutting Oils", and Mr. Earl Bastion of Shell Oil talked on "Coolants."

A symposium on machine tool lubrication and the election of new officers completed the May meeting.

A.S.L.E. National Committee Chairmen

Awards:
D. F. HOLLINGSWORTH
E. I. duPont de Nemours & Co.
Wilmington 98, Del.

By-Laws:
D. E. WHITEHEAD
Carnegie-Illinois Steel Co.
Pittsburgh, Pa.

Education and Training Program:
D. D. FULLER
Dept. of Mechanical Engineering
Columbia University
New York 27, N. Y.

Finance:
B. H. JENNINGS
Northwestern Technological Institute
Evanston, Ill.

Industrial Membership:
W. F. LEONARD
Room 1708, 343 S. Dearborn St.
Chicago 4, Ill.

Membership:
A. J. ZINO, JR.
27 Shoreview Road
Manhasset, L. I., N. Y.

New Sections
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5301-11 W. 66th St.
Chicago 38, Ill.

Nominating:
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Republic Steel Corp.
25 Prospect St.
Cleveland 1, O.

Program, Planning and Publications:
H. E. MAHNCKE
Westinghouse Research Labs.
East Pittsburgh, Pa.

Project and Publicity
E. M. KIPP
Aluminum Research Labs.
New Kensington, Pa.

Membership in the Society is in several grades as defined below. Assignment to grade is made by the Admissions Committee or Board of Directors on the basis of information submitted or supplied by references.

MEMBERS
$10.00

Members shall be: (1) persons not less than twenty-four years in age who are engaged in research and instruction at technical schools, universities and various publicly and privately supported institutions in the field of lubrication; or (2) persons not less than twenty-four years in age who have occupied recognized positions as Lubrication Engineers for a period of three or more (not necessarily consecutive) years prior to date of admission, involving the responsibility for or supervision of the development, selection, field use and application of lubricants as differentiated from other activities; or (3) persons not less than twenty-four years in age who are indirectly concerned with the field of lubrication, but possessing other qualifications of experience, knowledge and accomplishment, have manifested a particular interest in the purposes and welfare of the Society, to the extent that their membership would be a valuable contribution to the successful functioning of its activities.

JUNIOR MEMBERS
$5.00

Junior Members shall be: persons less than twenty-four years in age, and those who do not completely fulfill the membership requirements for Members.

INDUSTRIAL MEMBERS

Industrial members are such persons or organizations as may be interested in and desire to contribute to supporting the purposes and activities of the Society. The fees paid by an industrial member in general will not be allowed to exceed $200.00 per year.

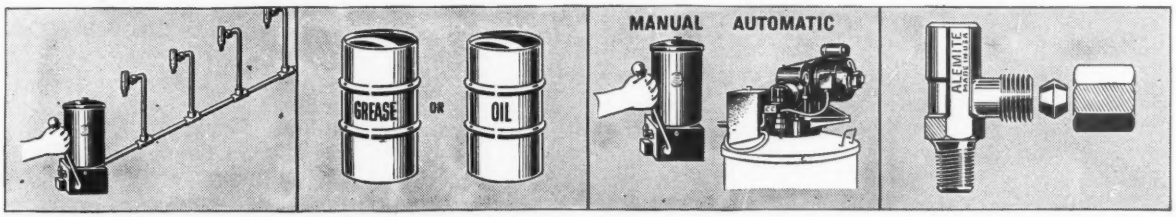
Shown is a Centrifugal Extractor with the Alemite Centralized Lubrication System "Built-in."

IT'S THE ALEMITE "MIDGET"

Centralized System...Small, Simple, Compact!

● Here's the new Alemite hydraulic measuring valve for Centralized Lubrication that handles either oil or grease. It is only slightly larger than the popular Alemite Fitting. Its small size and simple design make it highly suitable for application to all types of heavy, light and precision machines—especially where space limitations are encountered.

Ask for any technical help. Our Lubrication Specialists will gladly work with you on lubrication problems. They are fully equipped through training and experience to render valuable assistance. Ask for interesting demonstration of Alemite Systems right at your desk with transparent working models. Alemite, 1847 Diversey Parkway, Chicago 14.

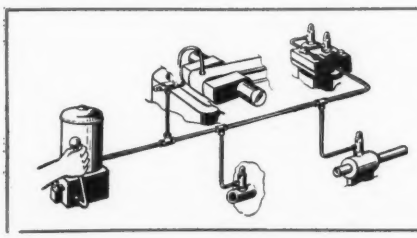


Low Cost, Single Line System. The valves can be mounted on or near bearings, to deliver a measured amount of lubricant from one central point while the machine is producing. No shutdowns, no bearing failures.

Handles Oil or Grease. There is no danger of over-lubrication or under-lubrication. An indicator signals when the lubrication is completed — eliminating human error. Production goes up...costs go down.

Manual or Automatic Operation. A hand pump may be installed in a safe, convenient place on the machine. Or, an Alemite air or electrically operated control will handle a group of machines automatically.

Built-In Compression Fitting is an integral part of the valve and included at no extra cost. No additional fitting is needed to connect tubing to the valve. This is an exclusive Alemite feature.



Serves Any Type of Bearing. Installation accessories are available so that the system can be adapted to rotary, oscillating, stationary—plain or anti-friction bearings.

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